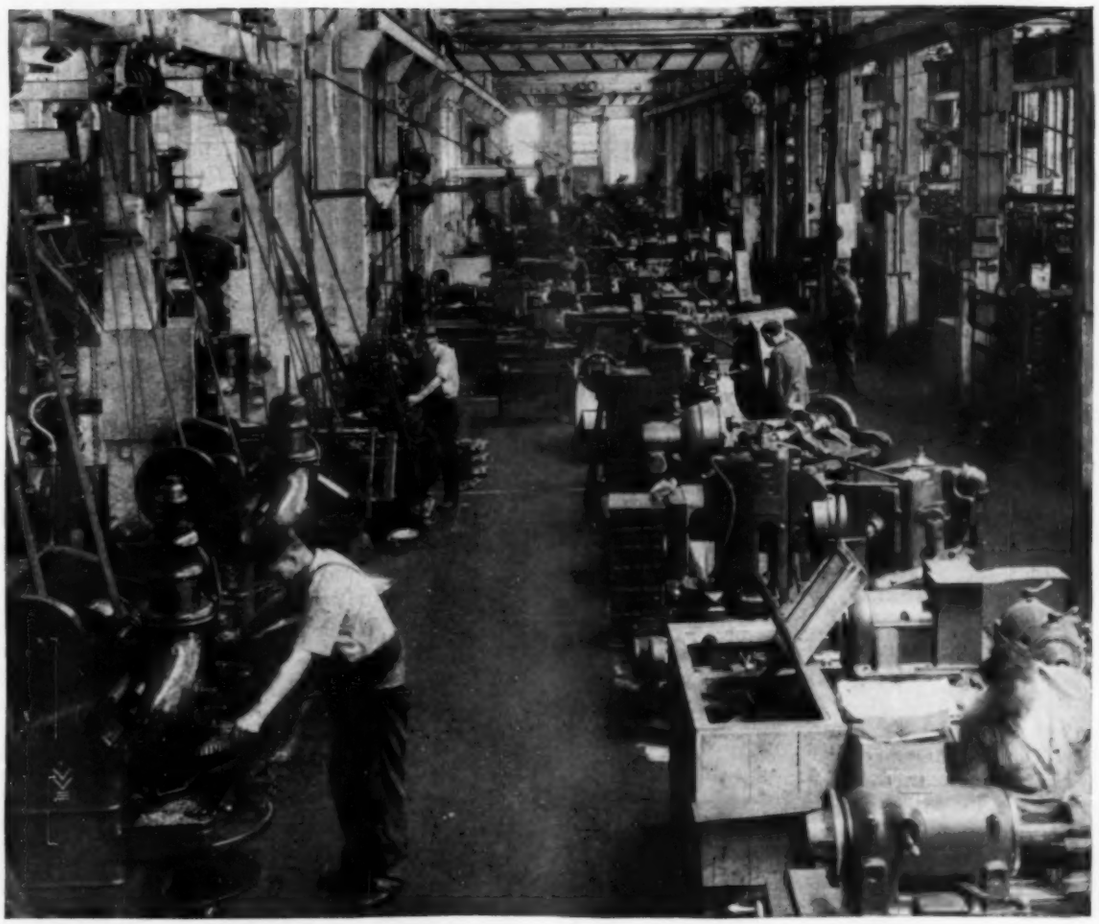
American Machinist

Established 1877
McGraw-Hill Publishing Company, Inc.

New York, August 20, 1931



Two old machines appear here, each 13 years of age. Offset by the yearling across the ais

Disposing of Ten-Year-Old Equipment

K. H. CONDIT
Editor, American Machinist

An interview with Robert M. Gaylord, President, The Ingersoll Milling Machine Company

MAKING the production department justify the retaining in service of machine tools and other equipment more than ten years old has been a basic management policy of the Ingersoll Milling Machine Company for several years. As a result, machinery more than ten years old is hard to find in the plant of the company. The profits derived have been surprising, even to those most firmly convinced of the wisdom of the policy.

It all came about through a realization that although the product of the company, like the products of most other machine-tool builders, was sold on its ability to earn, the equipment used to build the product was not being purchased on the same basis. It had been the practice to rebuild machine tools as they lost their accuracy or wore out otherwise, and the production

department could prove to its own satisfaction that this was more economical than the purchase of new equipment.

Six or seven years ago, when the obsolescence campaign carried on by *American Machinist* began to be talked about at machine-tool meetings, the Ingersoll management gave the subject careful study. The study showed that the usual custom of depending on the experience of shop executives for expert opinion in decisions to purchase new production equipment was being followed, and that this custom was failing completely to produce the economies in manufacture that modern equipment can accomplish. Some of these men had served their apprenticeship in the Ingersoll shop and had never worked elsewhere. Consequently they could hardly be expected to have the knowledge of the best practice in other shops that is so important when machine tools are to be purchased. This frank description of the situation is given here only because it is so entirely typical of so many organizations, and because it serves as a point of departure toward an unusually enlightened equipment policy. One other reason for stressing it is that it indicates a weakness in the selling organizations of both dealers and manufacturers. The salesmen should have been educating the production men on at least the fundamentals of equipment economics. But even the best of them were far better at explaining the peculiar merits of the machine they were trying to sell than they were at convincing the production man that it would pay him to work with modern equipment instead of rebuilding the existing equipment as it wore out.

As in most such departures from established custom the first attempts to apply the new policy were not entirely successful. The shop was called upon to supply a list of existing machines that should be disposed of. The list was not very long nor very impressive. There were apparently many reasons why certain old units should be kept in service, but the reasons failed to stand analysis.

Lists were made of all equipment over ten years of age and of all equipment over five years of age, and the cost of replacing this equipment was estimated, and the savings made possible by such replacement computed.

It was decided to replace some of the tools that were over ten years of age at once, while tools on the remainder of the list were to be retained.

In 1929 the regular practice of making an inventory of every machine over ten years of age was instituted. This inventory was divided into four groups:

1. Those tools that were being replaced by new tools on order or in transit to the shop.
2. Those tools ten years of age that were to be retained in service. The age of each tool, its machine number and description, and the reason why it was to be retained were included.
3. Those tools which were to be replaced. Age, number and description were included.
4. Those tools the replacement of which was undecided. Age, number and description were included as before.

Two days after this list was completed the production department was instructed to scrap all tools listed under the first classification. It was instructed to retain those in the second group, except for one battery of machines on which replacement figures were requested. A replacement estimate was also requested on all tools in the third group, as well as on certain units in the fourth classification.

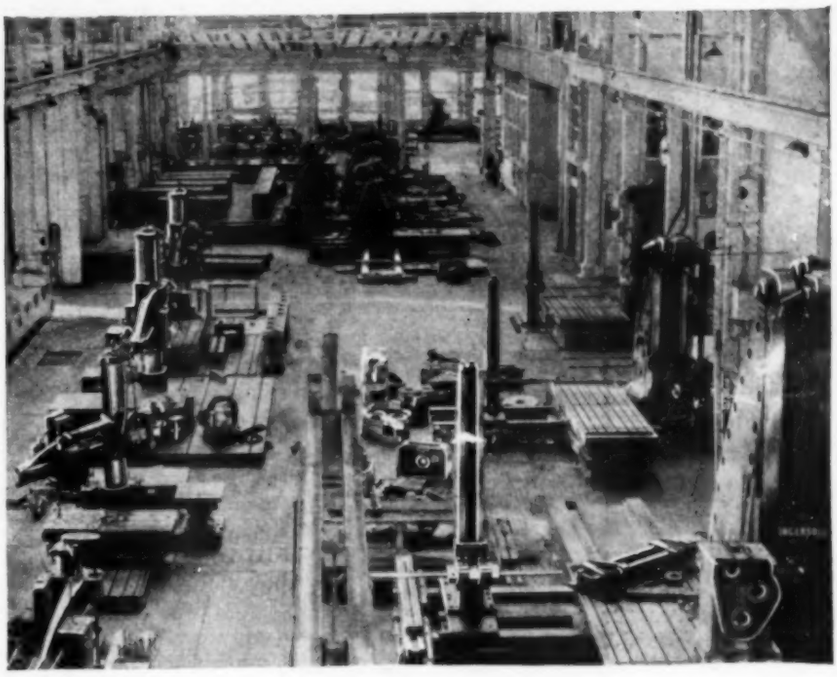
It was specified that replacements were to be based on the same total capacity for the shop as a whole. In other words, if two new lathes would do the work of five old ones no more than two would be purchased. The tendency of the production man is always to play safe and to seek a machine capacity a little in excess of what he had before. This tendency must be resisted unless the management is fully prepared to sell all of the additional product that can be made with the expanded capacity.

Six months later a follow-up memorandum to the production department elicited the information that the original instructions had been carried out for all four classifications of tools, with two or three minor exceptions. And after a year had passed new lists were made up including the tools that had reached the age of ten years during the period. The whole list was then studied as before to determine how these units should be classified.

No specific formula for determining whether a tool should be replaced has been developed. The nearest approach to one is the policy of authorizing the purchase of a new tool if it can save its cost in direct labor plus maintenance charges in five years. This is the maximum requirement. Many tools have been installed that fell short of it. They have justified their purchase through other savings.

Every machine in the plant is marked with stripes to indicate its age, bars representing single years, and V's representing units of five years. Some of the machines illustrated carry these marks where they can be seen in the photograph. The marks serve as a constant reminder to the production department and to the executives that certain units are deserving of suspicion as to their continued usefulness. Less than 15 per cent of the machine tools in service have passed the ten-year mark. This scarcely need be pointed out as an unusual record.

These cutter grinders are young. The one in the rear has only one stripe, the others two each



Replacement has given plenty of free floor space and work moves faster. Floor borer at right is two years old

In disposing of scrapped machines it does not pay to hold out too long for a higher price. A superfluous tool should be taken out at once to prevent work being done on it at an unprofitable rate when there is an overload on the shop. Even if an additional fifty or one hundred dollars is finally obtained the chances are ten to one that far more than that amount will have been paid out in space rent and other charges on the useless unit.

With only efficient equipment available the production planning staff will exercise its ingenuity and will manage to get out the extra work just as quickly as though the standby machine were at hand.

One of the intangible benefits that comes from the installation of new machines is the pride taken in them by operator and foreman. The new machine is kept in good shape, and the right kind of operator delights in getting the maximum performance out of it.

A short review of what has been accomplished in certain departments of the Ingersoll plant will show the tangible benefits of a good replacement policy. In the radial drill department, for instance, six modern tools have replaced ten having an average age of about twelve years. In addition to savings in floor space and in maintenance charges, there has been a direct reduction in machine time of about fifteen per cent.

Six engine and turret lathes have replaced eleven units averaging fourteen years old, and are saving fifteen to twenty per cent in machine time. Part of this saving is due to the use of the new cutting alloys, which was made possible by the greater capacity of the modern machines.

Two bevel gear-cutting machines have replaced four which were about eighteen years old. The saving here runs from twenty to thirty per cent.

In the internal grinding department seven out of eight units were replaced by five new machines. With one old one still in service the saving is eight to twelve per cent.

Four new shapers replace six old ones and save fifteen per cent, two thread millers replace four and save twenty-five per cent.

Nine heavy milling machines of Ingersoll make are in service. They range from one to five years in age. This department has always been kept up to date by selling machines regularly. A saving of not less than ten per cent in machine time is expected every time one of these relatively new machines is replaced, and the expectation has always been more than realized.

From the standpoint of the management this replacement policy has meant an increase in output per square foot of from 25 to 70 per cent, and in shipments from 50 to 90 per cent, with an increase in working capital of but 13 per cent, in capital investment of 30 per cent, and in labor of 20 to 50 per cent, the higher figure representing the peak of 1929.

Such a showing made with new equipment, most of which was of the general-purpose type, should go far to convert the production man who concedes large savings to so-called production machines but prefers to plug along with his old lathes and shapers. It indicts him as a failure in his job of producing maximum output at minimum cost. Remember that the Ingersoll business is such that machines cannot be made in lots. Each machine is built from special drawings and represents an engineering service applied to the particular manufacturing operation for which the machine is built. It is therefore more difficult to accomplish radical savings in its construction than would be the case if repetitive operations were involved.

In the building of single machines a large part of the cost reduction comes through the saving in fitting time occasioned by the greater accuracy of the modern machine tools. At times these savings are hard to isolate but they are nevertheless appreciable.

Another of the more or less intangible savings is the facilitation of the movement of parts through the shop resulting from the increased floor space and wider traffic aisles that can be obtained when a more productive modern machine displaces two or more obsolete ones.

In carrying out the Ingersoll modernization program the spotlight is turned on every piece of equipment more than ten years old. Each piece is considered critically every year. The management bases its decision to retain or replace the unit upon the experience of the shop and upon the production estimates of the builders of the proposed new machines. The shop men have been instructed to accept these estimates. It is up to the management to see that those who make them live up to them.

The managers of contract and job shops, and of shops making large units one at a time should find inspiration to better methods and equipment policies in this short account of the experience of the Ingersoll Milling Machine Company.

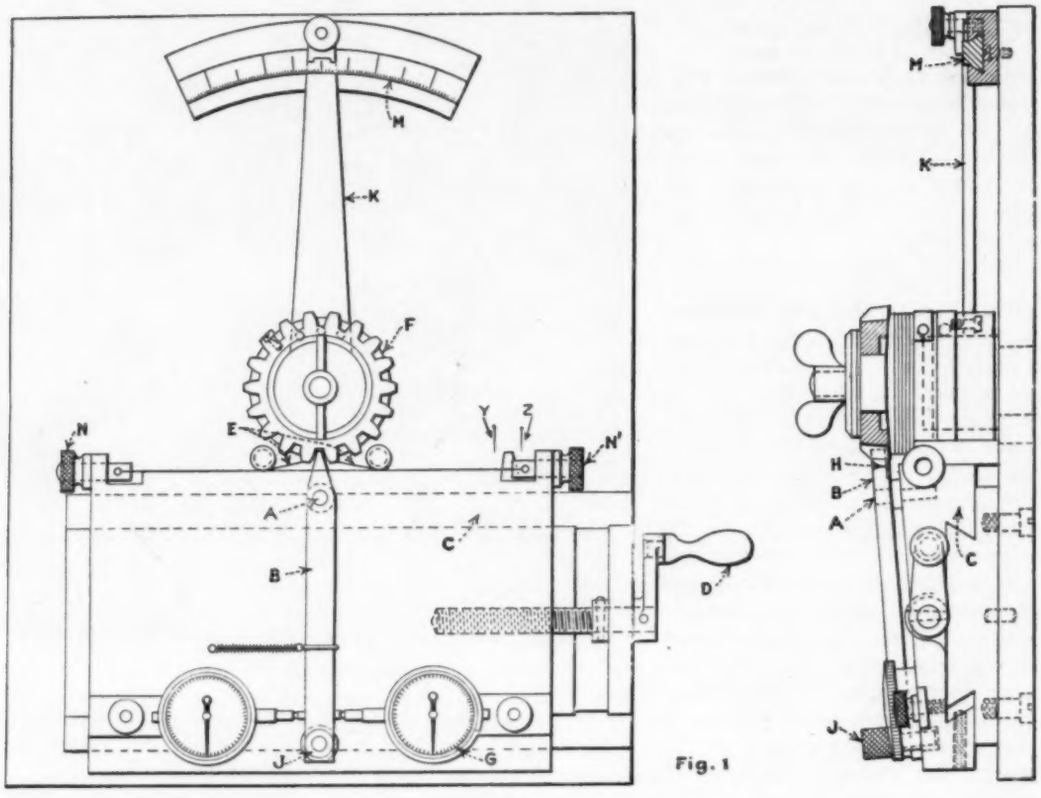


Fig. 1

A Gear Cutter Comparator

SAM TRIMBATH
Gear Engineer, The Willys-Morrow Company

Accurate gear cutting depends on accurate tools which in turn reflect precise methods of inspection

SOME years ago, it was necessary to make a device for the inspection of cutters for gear shapers. This was accomplished in the manner described below, and the resulting instrument has provided a reliable and satisfactory method of doing this work.

The method reverses the procedure generally used in producing the profiles of cutter teeth of this type. A pitch circle and the angle of a rack may be used to generate an involute; so to check the involute, we made an arrangement whereby the rack angle could be determined from a given pitch circle and the involute. Each side of the cutter tooth is inspected individually. The rack tooth at the end of lever—while ground to an angle corresponding to the pressure angle of the cutter to be inspected—can be made to represent an infinite number of angles by pivoting around *A*.

The rack lever *B* is mounted upon a slide *C*, which can be moved longitudinally by means of the screw crank *D*. Through the use of the steel tapes *E*, wound around pitch disk *F*, upon which the cutter is clamped, the disk is caused to rotate in unison with slide *C* and operate on the rack and pinion principle.

With the lever *B* free to act against indicators *G* and the cutter tooth brought into contact with the rack, no movement of the indicator hands should occur when slide *C* is moved. Should a movement be detected, the pitch circle and involute do not conform to the angle of rack. Two indicators are used—the one to the left being observed when inspecting the profile on left side of tooth space and the one to the right when inspecting right side. The instrument is set with slide *C* at *Z* and traveling towards *Y* when trying the left side and at *Y* traveling towards *Z* when trying right side. Both sides of a tooth space are checked without removing the cutter from the pitch disk. When any movement of the indicator hand is noted in a clockwise direction, it indicates that the angle of rack is not great enough to conform to the pitch disk and involute. A counterclockwise movement indicates that the angle of rack is too great. By returning slide *C* to the starting point and changing the angle of rack by pivoting the lever *B* around *A*, we can eventually make the angle of rack conform to the pitch disk and the involute.

For practical purposes, it is deemed sufficient to use the device as a comparator and aim to duplicate a reference or master, rather than to identify each cutter as having a specific pressure angle. For example, if two gears have base diameters corresponding to 20 deg. pressure angle and two others to 19 deg. 45 min., each pair would have true tooth action when operating together, but a 20-deg. gear would not interchange with a 19-deg.

45-min. gear. In other words, 20 deg. may be specified. but if we should happen to select 19 deg. 45 min. as a reference and make all succeeding gears and cutters with this pressure angle, no error is involved as far as true involute tooth action is concerned.

Indicators graduated to read to 0.001 are used, which is amplified approximately five times, through lever *B*. The amount of amplification varies from top to flank of tooth, because the point of contact between the cutter and rack changes. For this reason, we prefer to express the error as a difference in angle, rather than in parts of an inch. The difference in angle is computed as follows: From the center *A* to where the lever contacts with the indicator is 4.750 in. Now suppose the lever is moved until the indicator shows 0.021. This equals 0.00442 radians or slightly more than 15 min. The angle at the end of lever is then changed approximately five minutes for every 0.007 in. shown on the indicator. Now in checking a cutter that varies fifteen minutes from the master, there will not be a movement of 0.021, because only a portion of the involute is used for gear teeth as illustrated in Fig. 2. Take for example a cutter of eight diametral pitch, which deviates from the master fifteen minutes plus. With the indicators set so that no movement is shown at zero when checking the master, we would get a movement of about three graduations in this length profile when checking the cutter. If slide *C* is returned to the starting point and starting with the lever showing seven graduations plus, the movement over this length profile will be reduced to two graduations; when started at fourteen graduations, it will be reduced to a movement of one graduation.

In other words, as we more nearly approach the correct angle for the pitch disk and involute, the less movement will occur, until finally when we start with the lever showing twenty-one graduations plus, there will be no movement of the indicator hand. Had we started with the indicator registering twenty-five graduations plus, we would in this particular case, get a movement of one-half a graduation—only it would be in the counter-clockwise direction—showing we had increased the angle too much. This all is based upon the assumption that we are dealing with true involutes but with different pressure angles between the cutter being inspected and the master.

Had the profile been non-involute or some irregular shape, we would most likely detect a movement first in one direction and then the other, when the angle nearest the profile was found. However, this is something that rarely occurs. Most finishing cutters made by present-day practice will conform to some angle without movement of the indicator hand as great as the width of the hand itself.

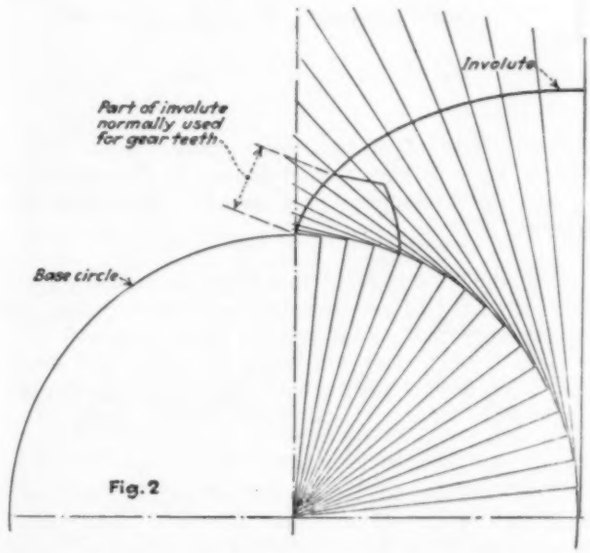


Fig. 2

Pinion-type cutters are usually ground 5 deg. on the cutting face and have a side clearance angle as well. For this reason, the reading is taken parallel to the cutting face, as two cutters reading the same perpendicular to the axis, but having different side clearance angles would not produce like involutes on gears cut with them. To make the reading parallel with the cutting face, the top of slide *C* is machined at an angle of 5 deg.

Because of the clearance angle on the side of the cutter teeth, when checking the cutter in the position shown, only the underside edge of the rack tooth contacts with the cutter. Thus the contact is made by a line and not the flat surface of the side of rack tooth. When questions of wear arise a light cut can be taken from the underside of the rack tooth at *H*. Then a new line on the rack will be presented to an unused surface of the master tooth. Plug gage *J* is inserted from time to time to make sure the position of the indicators has not changed from the position where the master was checked.

It is quite common to make gear teeth deviate slightly from the involute near the tops of the teeth, so that the tooth bearing will not be heavy at beginning of contact. This is accomplished by having what is termed a "flank" in the cutter, the involute not extending to the base circle. Arm *K* is attached to pitch disk *F*. We can then, through the arrangement of arm *K* and scale *M*, note where the deviation occurs with reference to the master. When the cutter is sharpened, the outside diameter is decreased and the center distance between the cutter and work is reduced. To keep the modification uniform throughout the life of the cutter, it should parallel the outside angle. It is then necessary, when comparing a cutter to the master, to allow for any difference in diameter. This is done by making a difference in the thickness of a washer under the cutter, allowing 0.005 for every 0.001 difference in diameter. The place where the modification occurs can be readily detected by a sudden movement of the indicator hand.

In the process of clamping the cutter in position contacting with the rack lever, it is difficult to place the indicator hands exactly in line with any given graduation. They are set approximately to the graduation desired and after clamping the cutter, brought exactly in line by means of thumb nuts *N* and *N'*. These nuts also keep the necessary tension upon the tapes.

Variations between the cutter being inspected and the master as small as two minutes can be readily detected. For example, with the indicators set so that zero is where no movement is detected when trying the master, a cutter showing two minutes plus will show movement of the indicator hand of less than one-half a graduation in the clockwise direction, when slide *C* is moved a distance necessary to cover an eight-pitch profile. Returning the slide to the starting position and changing the angle by having the indicator register six graduations plus at the start, there will again be a movement of less than one-half a graduation, when the slide is moved the same distance as before, only the movement will be counter-clockwise. The operator can check his decision in regard to the angle by observing these movements through changing the angle of rack tooth.

EXECUTIVE

Shifting the Burden

Multiple shift operation has been suggested as a means to utilize mechanical improvements and give more leisure to the workmen without increasing unemployment. To effect this throughout an industry, normally employing a single shift, would mean smaller or fewer plants running their equipment more hours a day. Thus the tremendous burden of idle machine time would be avoided. Is this the best way to make use of our mechanical facilities? Or is it just another palliative which would fail under the fluctuating load on our industrial set-up? What do you think?

SOME executives think only of the problem of the moment—others look ahead at the broader trends of industry. Henry K. Moore, President of the Eastside Machine Company, was one of those who liked to speculate on the economic and social aspects of business. Particularly he enjoyed exchanging ideas with his old friend, Bill Holland.

"Bill," said Moore on one occasion, when they were lunching together at the Manufacturers Club, "there's lots of talk going around nowadays on the advantages and disadvantages of the machine age. Some of it's logical and some quite the reverse. I've been connected with the manufacture of machinery since I was a boy and like to believe that mechanical development is leading us in the right direction. But there's one point that stumps me."

"What's that?" Bill asked.

"The argument that's put forward by most proponents of bigger and faster machines," said Moore, "that the greater the mechanical efficiency, the more wealth we'll have and the more time to enjoy it."

"Isn't it true?" said Bill. "We're bound to have periods of transition when certain groups of workers are displaced by new methods. But in the long run, history has shown that mechanization has brought higher standards of living."

"But where is it leading?" asked Moore. "We develop more efficient machines and work fewer hours. But in doing so, we get less use from our investment in plant and equipment, and overhead costs go up. That raises prices so we cannot afford to buy as much. The net result is that we've defeated the purpose of the highly efficient machines. What's the answer?"

"Multiple-shift operation," said Bill. "Reduce the working day if you will, but use more men on the same machines. Then you can keep down costs"

"I can think of several objections," said Moore. "Daylight hours are the natural time for work. Men work better and live better when following Nature's cycle of labor and rest. It's been shown, time and again, that shift work results in increased maintenance costs, lowered efficiencies, increased accident rates, and a higher rate of turnover. In many instances, these losses overbalance the savings."

"Careful planning of shift operation will largely overcome those objections," said Bill. "One company groups ten men for every nine jobs, giving each man five eight-hour shifts followed by sixteen hours of rest, and a sixth shift, followed by thirty-two hours of rest. This is in a plant operating continuously with three shifts. The plan does away with double shifts for shift changes and gives each worker a complete rest every week. Another concern works two shifts, one from 7 a.m. to 3 p.m. and the other from 3 p.m. to 11 p.m. This gives the men on each shift part of their daylight hours for recreation. With shorter hours, the arrangement would be still simpler."

"Most industries have too much capacity now," said Moore. "Instead of two shifts many executives have trouble keeping half a shift busy. If they attempted to step up production, they couldn't dispose of their product."

"I'll admit," said Bill, "that when an industry's overbuilt, it's hard to get back to a reasonable basis. But my argument still holds good if your industrial set-up is on a scale to suit the hours of work. Of course, you can't design plants with sufficient capacity on a single-shift basis and expect to operate them two or three shifts."

"But we have to face conditions as they are, not as we'd like to have them," said Moore. "Your solution is so idealistic, it doesn't answer my question."

FORUM

Discussions Of Former Subjects

Shirt Sleeves or White Collars?

The manufacturing end of any business is purely incidental to the main purpose for which the business was started; that is, for profit making.

Selling and shipping the finished goods and collecting the money are stages as vital to the attainment of profits as manufacturing. This being the case, I fail to see why the nomenclature is such that a shirt-sleeve worker, who might merely keep an eye on a machine or feed it raw materials, is "productive" labor, whereas the white-collar worker, who keeps records, advertises the products, sells them or secures remittances from accounts, is "non-productive." The productivity of the worker should be in relation to profit, and not solely to the manufacture of the goods. The white-collar man is equally as important, if not more so, as the laborer.

If there is need of any department to present the management with vital information, one should be organized, as the expense incurred will be more than offset by the resultant saving. Time and time again, the installation of a cost system, which discloses what products are unprofitable, has saved the company considerable money. —EPHRAIM SPERMAN.

Why Conventions?

Membership, convention, and exhibition expenses, like many of the indirect expenses of an organization, such as engineering, periodically come under fire from major executives. When this criticism arises from those who have first-hand knowledge of the facts through actual participation, it is indeed a serious charge against the society and convention system. However, in the vast majority of instances, the criticism comes from one who has never seriously taken personal part in these events. Then it is unfair, for it is difficult to evaluate in dollars and cents the intangible but real return. In fact, a real "Scotch" organization might even delude itself into the belief that it can occupy free seats on the sides lines and reap all the benefits—and wonder why it in time loses caste and orders in its industry.

The standardization work done by some of these organizations alone far exceeds in savings the combined dues and expenses of all its members. Then there is the opportunity afforded for the interchange of technical information and data at actual meeting sessions. Of course, it may seem a long stretch, but what one of us hasn't gotten some valuable dope in a hurry by calling up or writing a man we personally knew could help us, and whose acquaintance we first made at a convention? Perhaps, too, it doesn't mean anything to call on a sales mission, greet our customer by name, and recall a pleasant convention experience as an introductory remark to our sales talk? Conventions give us an introduction to the live men in an organization regardless of title, for those are the ones who attend. Of course, it may be argued that the superiority of our products should cause them to sell themselves. But if we can't get a hearing, what price theory? —FRANK KAHN,
Penn Athletic Club.

Buy Design?

It is wise to give detailed prints or parts for machines. Every machine has two or three weak points which do not show up on the test floor. After determining what these are, the manufacturing company should give not only the detailed prints of the first design but also a print of the redesigned part together with a quotation price.

Another consideration is the poor record keeping of machine manufacturers. We are having patterns made for loom parts because the textile machinery industry is far behind modern metal-working requirements and merely replaces with an identical part one which proves in service to be too light or weak.

There appears to be no ethical limit to the use of such information, the only control being the individual conscience. Necessity, due either to lack of time or finances, forces production men to go ahead and put through propositions regardless of ethics. —E. E. GAGNON,
Mechanical Superintendent, Raybestos-Manhattan Company.

Misguided Loyalty?

Criticizing a fellow worker is not ethical unless the criticism is made directly to the person criticized. I would resent the fact that my subordinate had though so little of my confidences as to give them all away at the first opportunity and hesitate before confiding in such a man again.

Because of this feeling, a coolness would probably arise between me, my helper, and our superior. It is such nagging, petty resentments between men that cause labor difficulties in a plant. It is neither logical nor ethical for an executive to encourage such criticism.

—W. G. BARTHOLOMAY, II.

Dismissal Wage

Although any man who has faithfully served an employer for a number of years is entitled to at least two weeks pay to tide him over his period of unemployment, in case of dismissal without just cause, legislation compelling such wages would not be just in every way. The biggest problem would be to determine who were the employees deserving such wages and what would constitute just cause for dismissal. It would be possible for an employer to find just cause for dismissal, should he so desire. It would also be possible for an employee to compel his own dismissal. There would be plenty of room for argument in either case. Any such legislation would often be unjust to either employer or employee.

Unemployment insurance offers the same complication. Firms having inaugurated this form of relief provide only for their employees during seasonal depressions, but give nothing to the man who is left out. During prosperous times there is no need of any such legislation, as any man who wants to work can ob-

tain employment within a reasonable length of time. Legislation regulating working hours so that there would be a job for every man who wanted to work, would be a far better solution. —W. J. OWENS, *Foreman, Newport Rolling Mill Company.*

I do think it is wrong for an employee to expect his employer to pay a dismissal wage, whether he be a salaried man or a day laborer. Why should the employer be penalized for laying off a man that he has ceased to need? If this man happens to have seen long service, he has received wages in proportion to his work and should have a nest egg laid away for just such an emergency.

One of the best substitutes for a dismissal wage was a system installed for a pension fund. This was of greater help to men who were laid off than to those who received pensions. Each employee was required to give two per cent of his wages to this fund, and the employer contributed an equal amount. The fund was used for old age pensions, but if an employee left the company for any reason, the money he had paid in was returned to him with three per cent interest.

About five years after this plan was installed, the company dismissed some of its personnel, and each one received a check that amounted to considerable more than a month's pay. If employers would install some such plan, the dismissal wage would be taken care of automatically. —L. G. PATTERSON, *Factory Superintendent, Armstrong Machine Works.*

Hours Gratis?

Men on the salaried staff of engineering concerns are often called upon to work additional hours, sometimes for a considerable period, without extra remuneration. The lack of uniform conditions throughout the industry, limiting the number of such hours, causes dissatisfaction. Although there is no limit set to the extra hours a man may be expected to work, there is generally a limit to the time he will get paid for if absent from work from any cause beyond his control. During busy periods, a salaried man cannot reasonably object to working extra time without additional pay, as this is compensated for by the annual vacation and also by other privileges which the man in the shop does not get.

Where it is necessary to hire extra men to complete designs within scheduled time, and these men are engaged on the understanding that they are temporary hands only but are expected to work the same extra hours as the other staff men, then they should be paid for any time worked in excess of the standard week. For permanent staff men, there should be a limit to the extra hours to be worked without remuneration, and any in excess should be credited to the annual vacation. If the staff man were paid for all his overtime, he would eventually find any privileges he may now enjoy would sooner or later be withdrawn. —W. L. WATERHOUSE, *Smethwick, England.*

Brain Fag

The desirability of rest periods depends greatly on the nature of the work in hand and the organization of the factory. Most workers deliberately arrange to take a few minutes leisure usually both in forenoon and afternoon. Even piecework and other forms of payment by results do not check this tendency. Officials and subordinates all show the same inclination. Whether these minutes of leisure should be organized depends entirely on circumstances.

Where works are organized for continuous production such as line assembly or where the slowing-up of certain individuals at irregular periods affects directly the progress of others, organized rest periods are desirable. But most forms of labor can safely be allowed to make their own arrangements. In the drawing office, such an organized arrangement is quite uncalled for. —PETER HYLOTT, *Glasgow, Scotland.*

Cash or Check?

The practice of paying employees by check is becoming more prevalent and is without question advantageous from the company's viewpoint. A favorable reaction from the employees depends frequently on the size and character of the company. A large reputable concern may pay by check without causing any inconvenience to the employee as confidence in the financial soundness of the company is prevalent throughout the community. Pay checks may be cashed at almost any store or bank. A small mediocre company does inconvenience its employees by paying by check. Considerable identification and credit is sometimes required because the company is unknown or in financial difficulties.

—E. THORNTON PACKHAM.

Filling the Gaps

Temporary departures from standard accounting practices to meet unusual conditions are not warranted. Making your own parts instead of buying them, unless utilizing available idle equipment does not reduce operating expense. Therefore it does not solve the management's problem of high overhead expense during quiet periods. The engineering department should try to redesign purchased parts so they can be made on available equipment, keeping in mind the vendor's price. This would only involve pattern and tool changes. If this is not possible, and the future looks as if the machine would be idle for some time, the management should endeavor to get outside work to do within the capacity of these idle machines. —CHARLES GARFIELD.

Does Frankness Pay?

Frankness undoubtedly pays not only from a financial point of view but from every aspect which has a bearing on one's self respect and peace of mind. Many a man has had the mistaken idea that he has outgrown his job. He should take a few days off and spend his time visiting as many plants as possible, preferably but not necessarily engaged in his particular line of endeavor. If, when he returns from this busman's holiday and has spent a few days in his own plant, he is still dissatisfied, he should give three months notice of resignation and seek pastures new. Usually this will not be necessary, for he would be so busy making comparisons and formulating new schemes to enhance the efficiency of the old job, the idea of a change would be shelved indefinitely. The man is seldom bigger than the job, he only thinks he is. New contacts lift a man from the mental rut where routine methods place him.

—ROBERT S. ALEXANDER, *Universal Winding Company.*

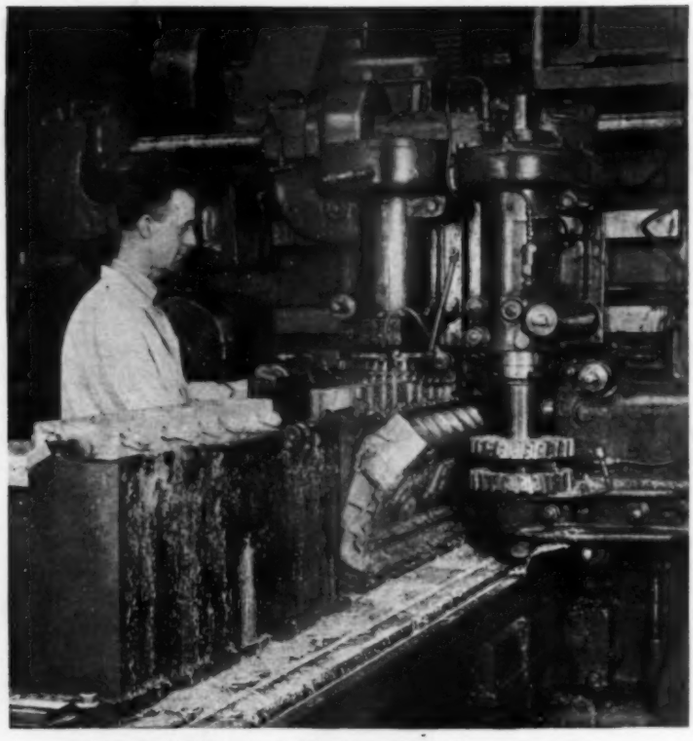


Fig. 1—Milling both blocks and heads at one pass

Marmon Sixteen Cylinder Blocks

SELECTING machine equipment wisely involves sound economics as well as sound knowledge of machines. It is one thing to select machines for economical production where the cost of highly special equipment can be spread thinly over a huge output, but it is a very different and a more difficult problem to select machines for high-class production in limited quantities. Special machines are not often to be considered in such cases. Standard machines that will give the desired quality of work at a minimum cost must be chosen. The equipment must be flexible enough to handle changes in design or to vary operations as occasion demands.

An excellent example of equipment that has been well chosen for a limited output of high quality is found in the plant of the Marmon Motor Company, Indianapolis, Ind., in which the new Marmon Sixteen is being built. Standard machines have been selected in nearly all cases, and the desire for a first-quality product is seen all down the line.

Fig. 2—Double drilling fixture for block and oil base

The engine of the new Marmon has a Lynite cylinder block, which also forms the water jacket around the steel sleeves and acts as the cylinder walls, a construction that differs from any other automobile engine and one that involves a number of special operations. The first machining operation is to mill both the cylinder blocks and heads on the Ingersoll machine in Fig. 1. Fixtures for holding first a block and then a head equalize production and make one machine do double duty.

Bolt holes in the flanges of both the cylinder block

and the oil base are drilled by using both sides of the trunnion fixture in Fig. 2, alignment thus being assured. The ends of the block are then milled on a double-head Cincinnati machine and a No. 4 knee type mills the sides for the manifolds. The valley between the two banks of cylinders is milled on the same machine after which the same fixture is moved to a vertical No. 4 for further operations, showing both economy in fixtures and the practical advantages of standard table slots.

A special Kempsmith machine straddle mills the bearing supports, Fig. 3, the next step being to lap the flange face for the oil base on a cast-iron plate, long a Marmon custom. Rough boring for the cylinder sleeves on a Hole-hog follows, as in Fig. 4. Four bars are used, boring alternate cylinders of one bank.

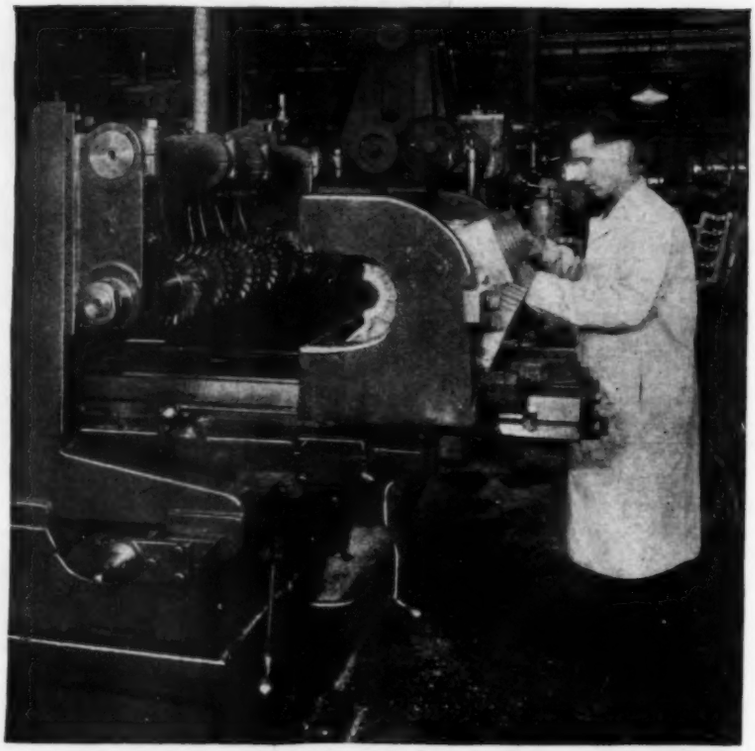


Fig. 3 — Straddle milling shaft bearing supports

Fig. 4—Rough boring for cylinder sleeves

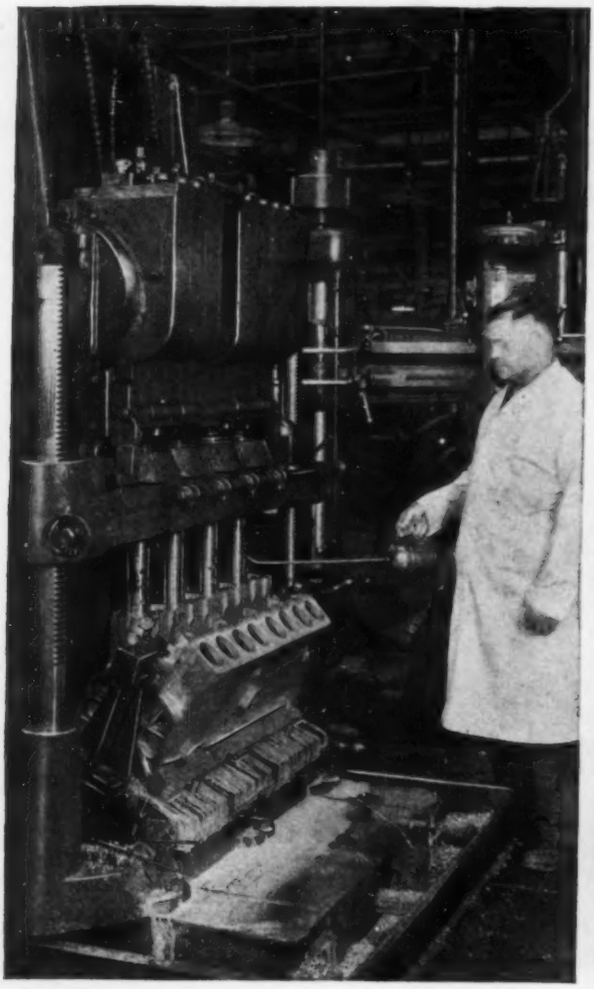
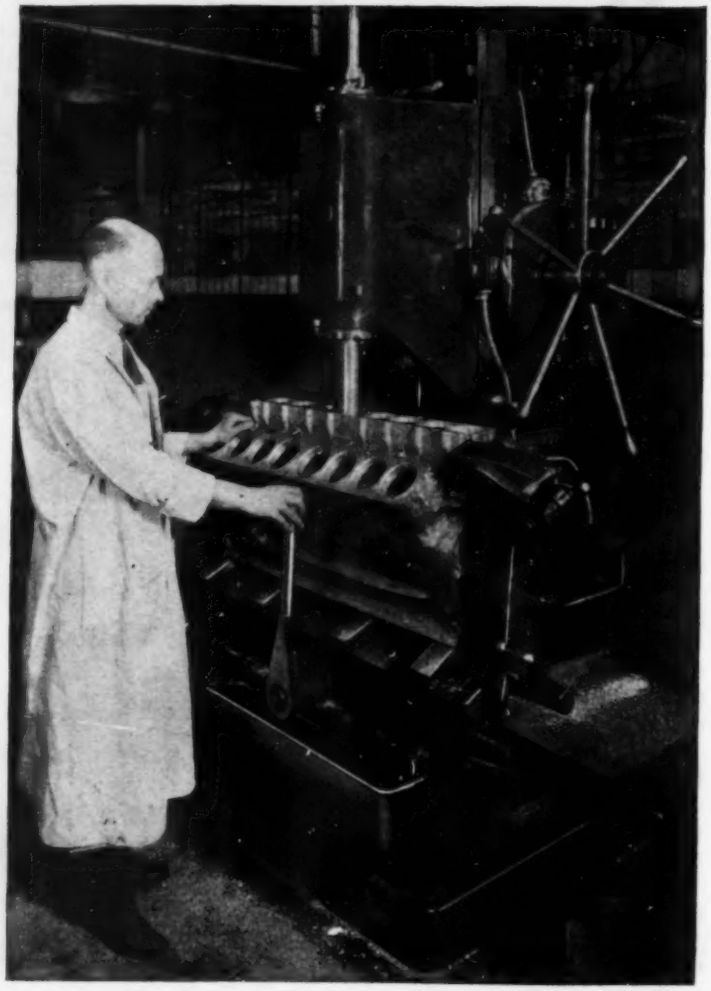


Fig. 5—Finishing the bores for cylinder sleeves with a single bar



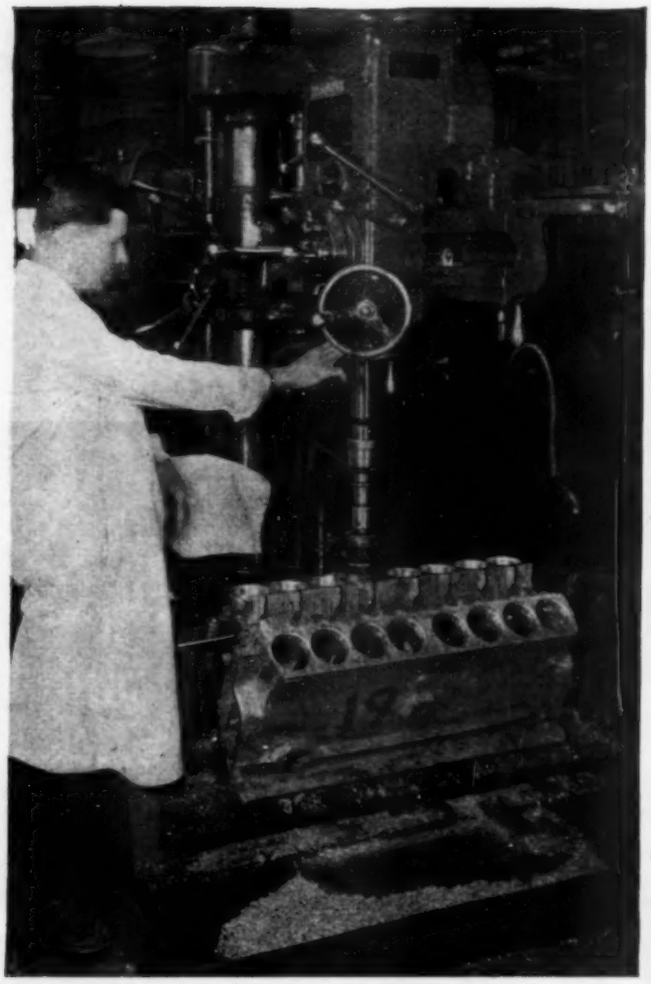


Fig. 6 — Cutting grooves for packing rings

the cutter *D*, through suitable keys. Collar *E* enters the upper end of the cylinder hole and supports the pressure of the spring between the two collars *H* and *J*. A ball thrust collar reduces friction at this point.

After the tool is in position, with the flange of collar *E* bearing on the top of the block, the down movement of the spindle forces the angular end of the bar *C* through a corresponding opening in the cutter *D*, forcing it out and cutting the three grooves previously mentioned. As soon as the cutter begins to move out, the safety catch *K*, welded to the back end of the tool, enters the groove in the guide bushing in the base and prevents the tool from being withdrawn while the cutting edges project from the body. This little device prevents spoiling a cylinder block from this cause.

Push broaching is used to surface the bearing cap face as illustrated in Fig. 8, which shows the vertical American machine and the broach used. Drilling the end and side holes in a trunnion fixture is followed by drilling and tapping for the bearing studs, after which the main and camshaft bearings are rough bored on a Rockford machine.

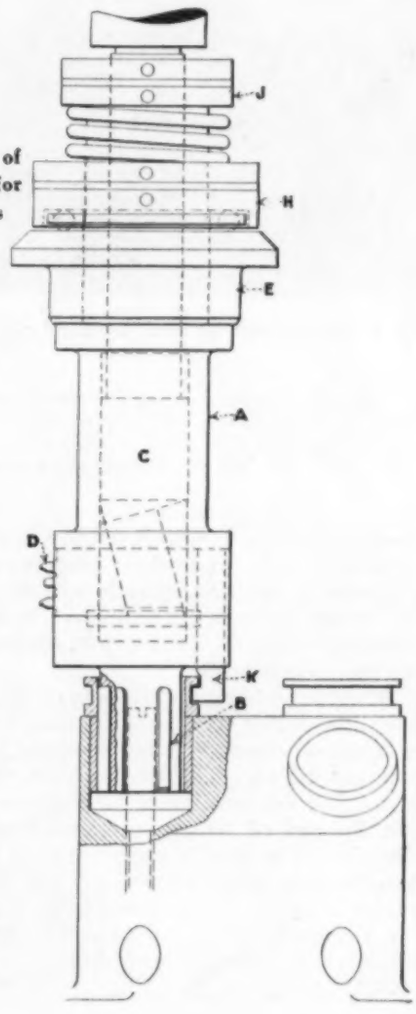


Fig. 7—Details of expanding tool for cutting grooves

The fixture is then indexed to bore the intermediate holes, and then swung to the proper angle for boring the other bank in the same way. Finish boring is done with a fly cutter in a single-spindle Foote-Burt, Fig. 5, indexing for each bore. The outer end of the hole is counterbored to receive a small flange on the sleeve. Carboloy tools are used for both rough and finish boring and in many of the other operations.

Rubber rings, or grommets, are used to seal the joint between the sleeves and the cylinder block. These rings fit into grooves in the block, two rings being used at each end of the sleeve. A third, central groove, cut midway between the two used for packing, allows, for the escape of any water that may get past either of the two rings. The grooves for these rings are cut with an expanding tool, as in Fig. 6, in an American radial. The pressure of the collar on the cylinder block expands the formed grooving tool into the block. Details of this tool are shown in Fig. 7.

A study of Fig. 7 shows not only the way in which the recessing tool is made and operates but also the care taken to secure accuracy. The body of the tool *A* slips inside the cylinder block bore, the pilot *B* fitting a guide bushing in the base of the fixture. The pilot carries four hardened guide strips that bear in the hardened bushing. Inside the body is the bar *C*, driven by the drill spindle and in turn driving the body *A* as well as

Each bearing stud hole is counterbored to receive half the length of a steel ring or sleeve that acts as a dowel. These dowel holes are carefully line reamed, the ring or sleeve dowel being independent of the stud itself, as in Fig. 9. With the cylinder block located by these dowel holes, both the crank and

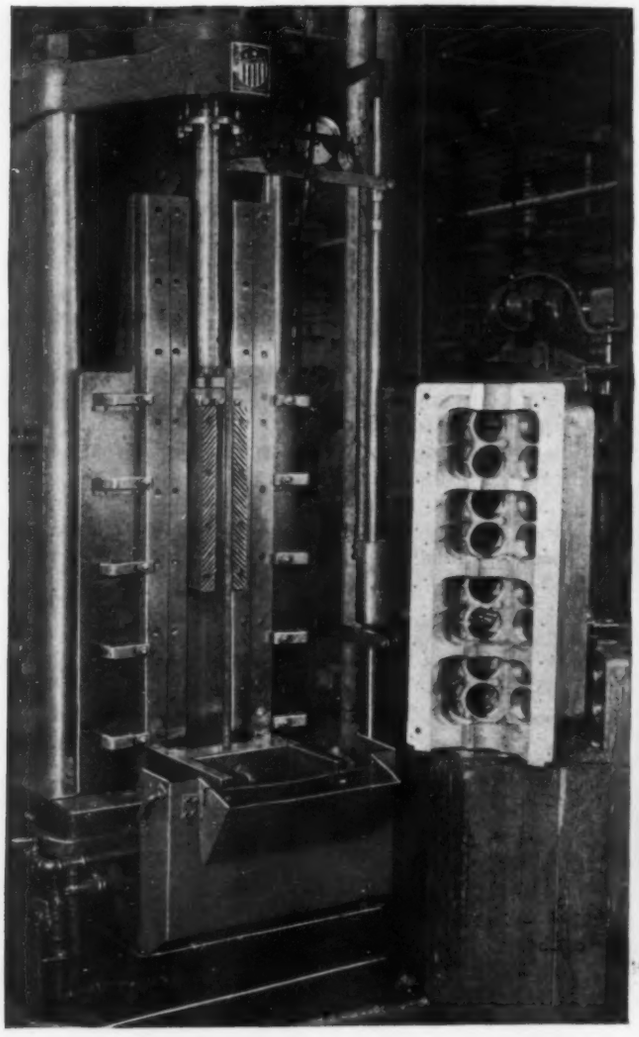
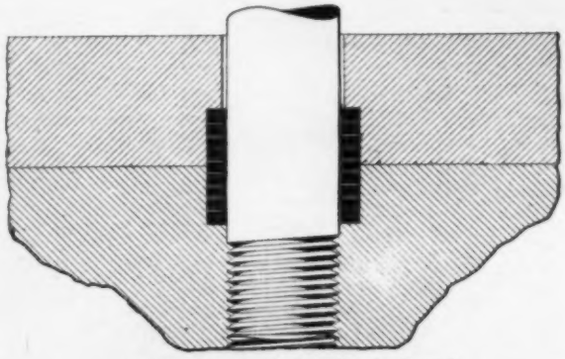


Fig. 8—Push broach for shaft bearing faces



ig. 9—Detail of the sleeve dowel

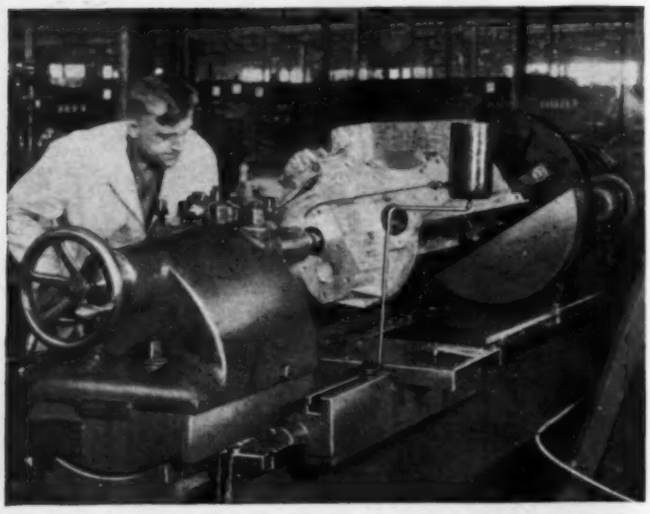


Fig. 10—Boring housing for clutch and transmission

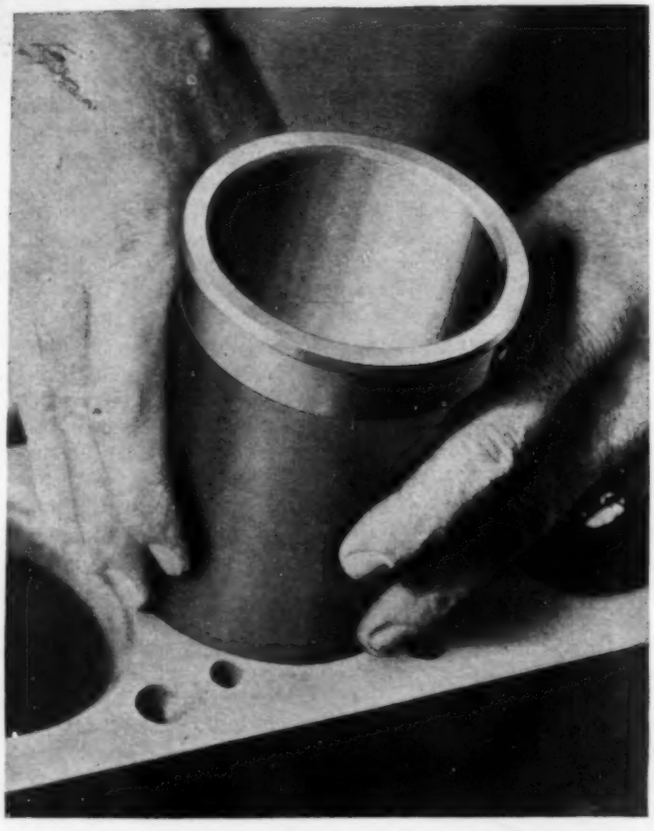


Fig. 11—Putting the cylinder sleeve in place

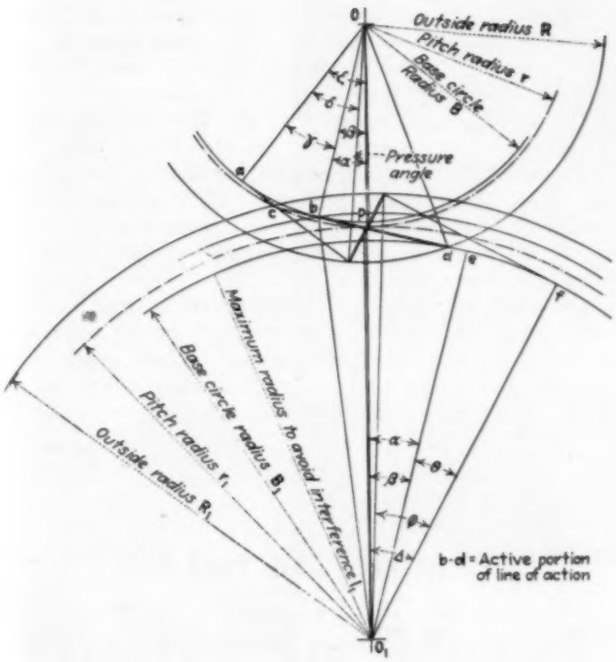
camshaft holes are finish bored in a LeBlond lathe with suitable fixtures. Camshaft bushings are then put in place and trimmed. Again located by the dowel holes the valley between the cylinders is milled to finish distance. This is held to close limits as it positions the valve mechanism.

After the drilling and tapping of the remaining stud holes, the heavy steel plate forming the motor mount is bolted on the end of the block and the transmission case assembled. The unit is then run on an arbor in a LeBlond lathe with counterbalanced face plate, and the end of the transmission case is faced as in Fig. 10. The steel sleeves are then put in place by hand with a good sliding fit, Fig. 11. Putting the rubber rings in the grooves makes it necessary to tap the sleeves in with a light, soft-faced mallet. The block is now ready for assembly.

This is the first of three articles.

Gear Tooth Contact

Discussion


Outside radius R
Pitch radius r
Base circle radius B
Pressure angle
Maximum radius to avoid interference I1
Base circle radius B1
Pitch radius r1
Outside radius R1
b-d = Active portion of line of action

CARL A. E. JOHNSON

THE ARTICLE on "Gear Tooth Contact," by T. R. Rideout (*AM*—Vol. 74, page 455) was interesting. The author derived a formula which is much easier to handle than the more familiar one previously used. There is one point, however, which should be mentioned in order to avoid misuse of the formula by men who are unfamiliar with gearing. The same limitations also apply to the old formula.

When the point b (the point of tangency of the line of action and the base circle of the pinion) lies inside of the outside circle of the mating gear of radius R_1, the length of contact is bd instead of cd as there can be no involute action below the base circle. A circle of radius I_1 passing through point b is the largest one to avoid interference. Therefore in any calculation for gear tooth contact, the radius I_1 should be used if it is less than R_1. Thus in the new formula, I_1 should be substituted for R_1 in the formula for cos ϕ. The new formula for cos ϕ becomes $\cos\phi = \frac{r_1 \cos\alpha}{I_1}$ and the formula for K is used without any change.

In the old formula for K, the numerator is equal to the active portion of the line of action cd, the denominator is equal to the normal or base pitch P_n, and of course: $K = \frac{cd}{P_n}$. In the modified formula used when I_1 is less than R_1, the numerator is still equal to the active portion of the line of action which in this case is bd, and $bd = \sqrt{R^2 - (r \times \cos\alpha)^2}$. The denominator is equal to P_n and $P_n = P^1 \times \cos\alpha$.

Then: $$K = \frac{bd}{P_n} = \frac{\sqrt{R^2 - (r \times \cos\alpha)^2}}{P^1 \times \cos\alpha}$$

In any case, no matter which formula is used, the maximum radius to avoid interference should first be determined as follows: $I_1 = \sqrt{B_1^2 + (OO' \sin\alpha)^2}$. If I_1 is less than R_1, the formula for length of contact should be modified as explained. The same symbols are used in this discussion as were used in the original article.

FRANCIS W. SHAW

Mr. Rideout's formula is only applicable to those gears in which the involute interference points A, in Fig. 2, lie on or beyond the outer circles of the teeth, or in which the interference portions of the tooth profiles are conjugate. But unless this conjugacy exists—and it seldom does—the only portion of the line of action that can be counted on for contact is that extending between the points A and not between the points I as Mr. Rideout's exaggerated diagram indicates. As drawn, the pressure angle is about 30 deg.

To calculate the number of teeth that will be in action together on this shortened line is an exceedingly simple matter, for in gears of unity module or unity diametral pitch, the base pitch P_o (pitch along the line of action) is:

$$P_o = \pi \cos\alpha \qquad (1)$$

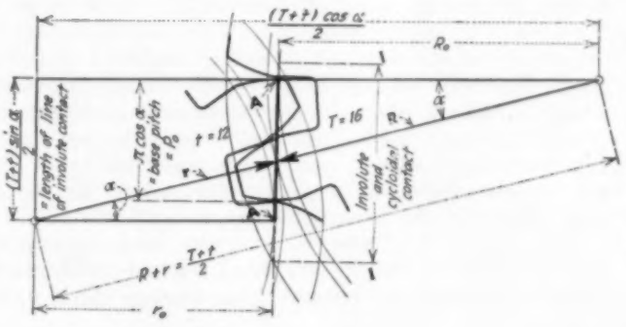
and the length of the contact line is:

$$AA = \tfrac{1}{2}(T + t) \sin\alpha \qquad (2)$$

where T and t are the respective numbers of teeth. From which the number of teeth in contact on AA is plainly:

$$\frac{AA}{P_o} = \frac{\frac{1}{2}(T + t)\sin\alpha}{\pi \cos\alpha} = \frac{\frac{1}{2}(T + t)\tan\alpha}{\pi} \qquad (3)$$

To determine the sum of the numbers of teeth in a


(T+t) cos α / 2
Ro
(T+t) sin α / 2 = length of line of involute contact
π cos α = base pitch = Po
T = 16
t = 12
Involute and cycloidal contact
ρ+r = (T+t)/2
ro

mating pair so that the involute action shall be continuous is also very simple. Referring to the diagram, we note that if

$$\tfrac{1}{2}(T + t)\sin\alpha = \pi\cos\alpha \qquad (4)$$

there will be continuous contact, for AA is then equal to the base pitch. From (4) it follows that:

$$T + t = \frac{2\pi\cos\alpha}{\sin\alpha}$$

$$= 2\pi\cot\alpha \qquad (5)$$

Evaluating $T + t$ by Formula (5), we gather that:

for $14\frac{1}{2}$ deg. standard gears, $T + t = 24.3$
for 20 deg. standard gears, $T + t = 17.3$

We must not forget that in any pair of gears in which the addenda extend beyond the points of interference the points must be eased to obviate undercut flanks. Provided that steps are taken to counteract undercut, the tooth sum as now calculated can be divided in any practicable manner between the two gears.

Comparisons of Piston Practice
Discussion

Pistons play an important part in the automobile manufacturing program, both as to numbers and to accuracy. Thus both of these factors give added importance to the methods used. For, on the basis of estimated production for 1931, about 20 million pistons will be required for new cars alone, and perhaps 5 million more for replacements.

With this output in mind the methods used in manufacture become important, and it is of interest not only to study those outlined by Prof. A. P. Gwiazdowski (*AM*—Vol. 74, page 903), but to compare them with the methods illustrated in 1920, showing the practice of the leading shops at that time. Such a comparison shows a somewhat surprising similarity in method. The differences being largely accounted for by changes in piston design and the increased use of light alloys. Two noticeable changes are the elimination of the relief on the side of the piston on two of the pistons shown recently and the introduction of grinding as a finish for the outside. One, however, grinds the bottom end of the skirt oval. Grinding had not become common practice 11 years ago, having been used by only one or two engine builders, and by those strangely enough, which turned out the smallest production.

Of eight builders in 1911, four of them bored and faced the open end to be used as a locating point for future operations as do all three of the builders mentioned in the latest practice. Three of them rough turned the outside first, all but one of the eight centering from the inside to secure even wall thickness. Four rough bored the piston hole as a second operation and five of the eight finished the ring grooves as one of the last operations. Where projections were left for a center on the solid end, facing of this end of the piston was frequently the last machining operation.

The growth of grinding as a regular machining operation is clearly shown by the later methods. In nearly all cases pistons are ground from two to three times, although manufacturer *B* in the Gwiazdowski article still turns instead of grinding. While engine builders have always tried to secure pistons that were round, to have piston pin holes square with the bore and with a true bearing surface, the added experience and the better machine equipment now available results in a better product than ever before and at lower cost. For even with the increased number of operations indicated in the case of manufacturer *C* the cost is probably lower than it was 11 years ago. Whether the extra operations and the greatly increased time per piston are justified in the product is a matter on which opinions may differ widely. The real test would seem to be a comparison of the results in actual use in the engine to include both performance and maintenance. For temperatures and actual running impose conditions that can rarely be foretold by laboratory tests.

Taking the piston-pin hole as one item we find manufacturer *A*, the cheapest car of the three, drills and rough bores the holes in the fourth operation, and rebores and finish bores in the eleventh. Here are really four operations at two settings. Manufacturer *B* drills, rough and finish reams at one setting while *C* uses three settings and five operations.

The author's conclusions are excellent but it seems as though "high grade" tooling might better have been described by the word "elaborate." High grade, as a term, seems to be tied up with quality which is not confined to the quantity produced.

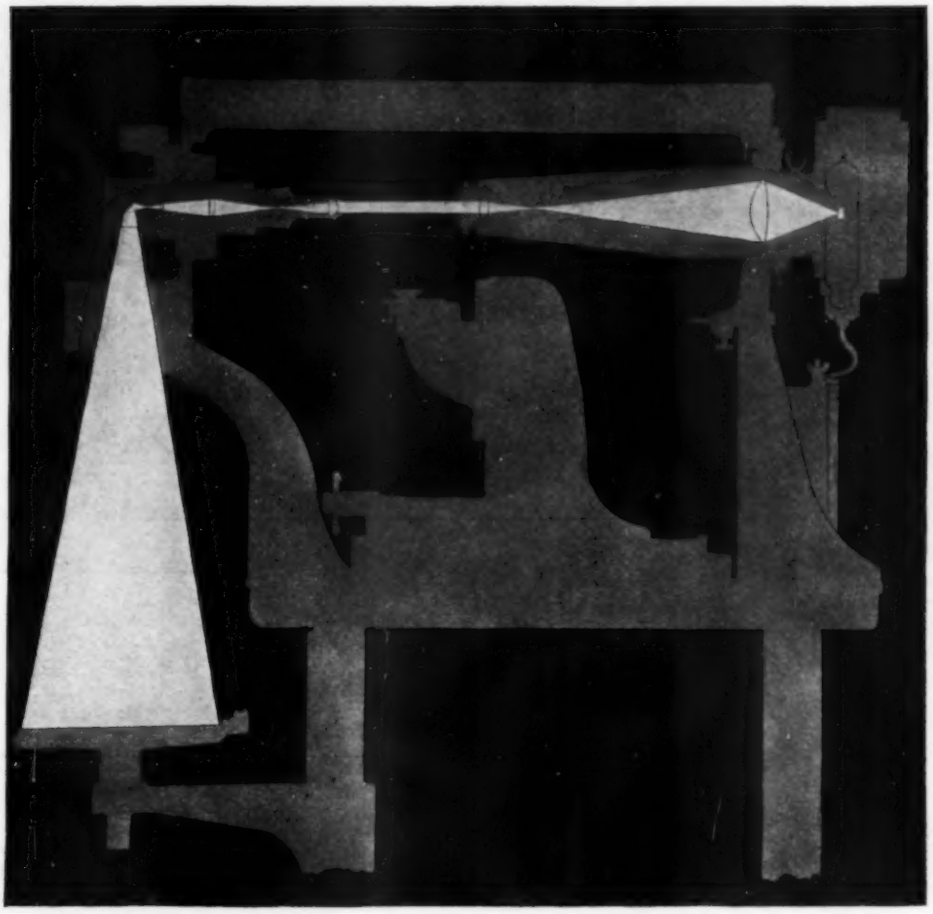
Chattering and Tool Life

J. T. TOWLSON
London, England

Some little time ago a writer in the *American Machinist* when referring to the chattering of lathe tools stated that the tool had to be ground more frequently than would have been the case had no chattering occurred. A steam engine cylinder of 36-in. base, and incidentally an extra hard casting, was set on a rather too light lathe for boring. A good automatic feed boring bar was available, and the boring head was nicely padded with wood—in a way well known to good turners. Still the tool did not behave as was desired, and did not last nearly as long between grinds as it should have done. The calculated speed was correct for hard cast iron; and the cause of such abnormal wear of the tool had to be ascertained. It was found that the lathe and its belt drive was too light for the job. The chattering was mainly evidenced by the boring head stopping and going again hundreds of times during each revolution.

As it was impossible to make a satisfactory job of the cylinder on that lathe, the job was transferred to a heavier one. This lathe was run at the same speed as the original one, but without chattering and the boring was successfully done without excessive regrinding of the tools.

Why did the tool require more regrinding with the chattering lathe than with the heavier lathe since both were run at the same speed? Although the calculated speed was, say 50 ft. per min. for the light lathe, its intermittant operation took up time and the tool had to go much faster between stops to make up for it.



Path of light through the contour projector; the part to be outlined is placed in the path of the parallel rays which are afterward diffused

Optics in Metal Working

III—Contour Projector and Microscope

KEN G. NIBLACK
Bausch & Lomb Optical Company

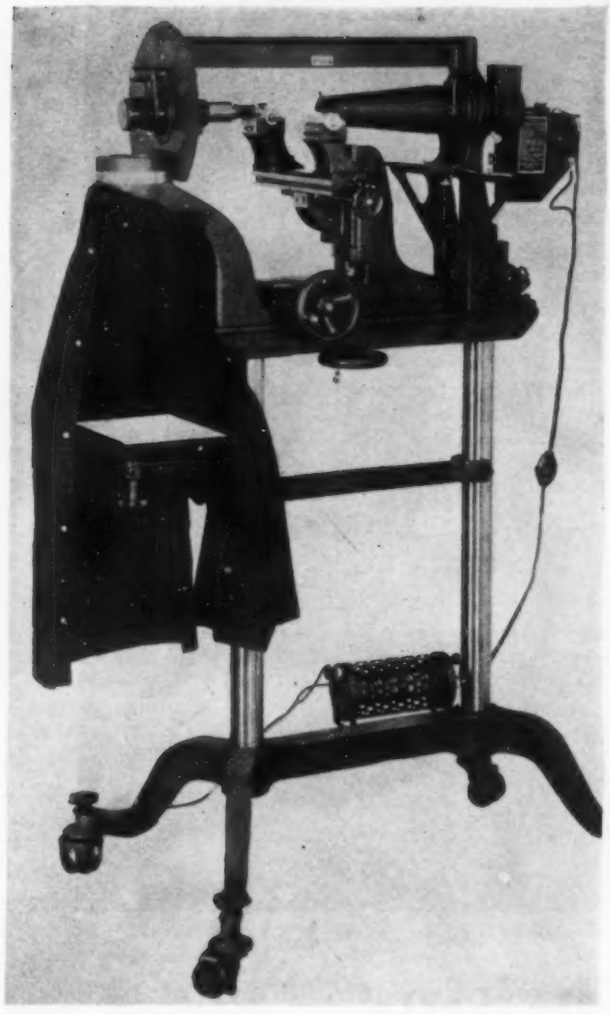
MANY methods and tools of the greatest value to industry today had their inception long ago. These developments or inventions were nurtured in the secrecy of the crafts and guilds; they were not broadcast through business magazines and made the common property of industry, as is good, sound practice today. Methods and tools developed in one industry are often of greater value in some unrelated industry, and considerable research today is carried on to find out how to adapt them to more universal use.

The optical industry is very old. Eyeglass lenses were made in ancient China; they were made in Europe before the time of Columbus; and during the 18th and 19th centuries the optical industry perfected its methods for achieving the close accuracy required for manufacturing scientific optical instruments. Magnification and projection, the optical lever, and interference methods were all used in the past century; but it is only during the last few years that they have been considered necessary in the metal-working industry. The precision and convenience of optical methods, long known to astronomers, surveyors, navigators and research scientist, are now increasing the efficiency of the machine shop.

Magnifying a small object in order to measure or compare it, is a long-established practice; and the contour measuring projector, more recently developed, is an instrument making use of this principle. It consists of a light source, special equipment to hold and manipulate the piece to be examined, and an optical system to project its contour. When the contour of the part is enlarged sufficiently it can be measured or compared with standards, greatly reducing the possibility of error. Parts of unusual form that can be measured by no other method are often easily measured or examined on the contour measuring projector.

The instrument is equipped especially for grazing light, that is, for inspecting or measuring the contour of parts illuminated by a parallel beam of light for projection onto a screen or chart. It may be used, however, with reflected light for such parts as have polished surfaces.

A cast may be made of many characteristics that can-



The contour projector set up for use

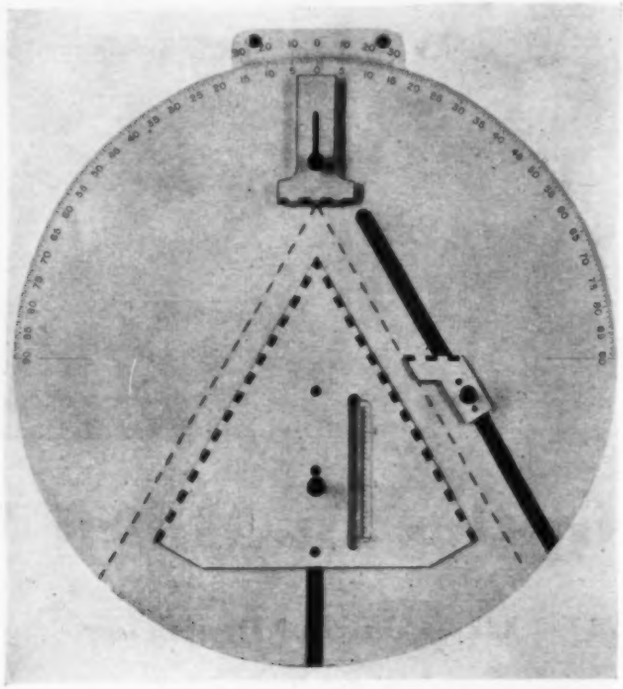
not be examined by the usual method, and a sulphur cast equipment is available for making impressions of inside threads and examining them on the contour projector.

With the projector the accuracy of sealing rolls for tin cans are checked to the ten-thousandth part of an inch. Many types of cutting tools are inspected as are also small motor parts. At other places the projector is used for inspecting the operation of gears in mesh; for comparing special forms of gear teeth; for inspecting and measuring circular form tools, staking and swedging tools, templets used in making punches and dies, master distributor cams used in ignition heads; for checking sample cams when setting up production machines, and for inspecting various punch-press parts used in typewriter and electrical stock recording instruments. It finds use also for checking diameter, angle and lead of thread gages, keeping shape records of hobs, lead screws, taps, thread gages and form cutters. Plug gages are checked, telephone plugs, and sample parts from screw-machine set-ups are inspected, as are also irregular contours of office machine parts.

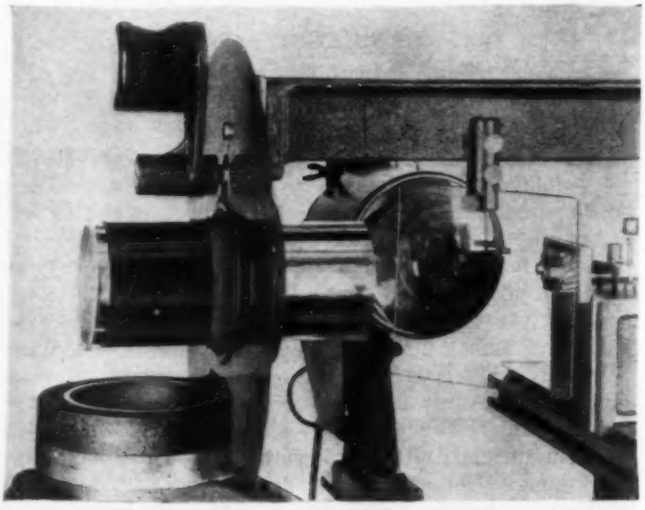
Industry cannot expect to manufacture small, accurate parts that will stand the test of magnification for inspection unless it uses means to obtain the desired accuracy in its initial measurements. And it must have the facilities for carefully checking the different operations that might cause inaccuracies in order, when necessary, to practice more precise methods of making tools and setting up the tools.

A low-power microscope mounted directly on the machine is a valuable aid in such cases. The magnification should be quite low for this kind of work, perhaps between ten and twenty diameters. This will bring out many details unnoticed with the naked eye. Because the biologist and metallurgist use magnifications in the thousands, we are inclined to call ten diameters low power, but if we were to enlarge our desk ten times, it would be the size of a house and we would be able to use a lower drawer for a garage. The low-power microscope with its large field of view and high eyepoint is ideal for examining materials in the process of being formed. The optics are mounted in an inexpensive tube which can be clamped or mounted in any position on a machine.

A special glass disk having cross lines, angles or scales



Adjustable thread chart upon which the silhouette of a male screw thread is focussed for measurement



To obtain vertical illumination, a piece of glass placed at 45 deg. angle reflects light on the object which is then bright enough to be focussed on a chart

Toolmaker using a cross line telescope for centering

engraved upon it can be mounted at a position in the tube to bring the markings on the same plane as the image. The operator sees his work and the markings are apparently located on its surface. He is enabled to make measurements or comparisons while the work is being done, to watch the functioning of the tool, or perhaps to set the tool or the work before starting the machine. For a few dollars, almost any type of engraved glass disk may be obtained.

Microscopes from five to fifty power are used in machine shops. They are used for precision indexing in conjunction with an engraved steel disk mounted on the head of the machine. They are used to set the tools, the milling cutters, or to center work before boring, etc. They are often mounted permanently over a finely graduated scale that moves with the work. The correct graduations on the scale are brought into coincidence with the cross line in the microscope. This procedure is recommended when cutting parallel work such as racks where close precision must be maintained.

If it is desired the microscope tube may be mounted directly on a rack and pinion focusing arrangement. For ordinary inspection work on bench or table, the wide field microscope tube can be equipped with a tripod support or a tube which may be adjusted to the proper focal distance for setting this instrument on work to be examined.

Third of a series.

Time Study Computations by Slide Rule—*Discussion*

A. ANDERSON, JR.

Engineer, Monroe Calculating Machine Company, Inc.

IN TIME-STUDY calculations, the calculating machine is finding a field of application of increasing importance. For this sort of work, where versatility is important because of the variety of computations involved in present-day time-study analysis, a calculating machine furnishes the only means of turning out the results by a completely mechanical process.

While the slide rule is used, as described by W. G. Holmes (*AM*—page 467, Vol. 74), the disadvantage of this method is that the figure work includes addition and subtraction as well as multiplication and division, so that only a portion of the computations can be done mechanically, the remainder being done with pencil and paper or by mental processes. Where the problem is simple, the slide rule can be used advantageously, but where the numerical work is at all involved, the calculating machine cannot be approached for speed, ease of operation or accuracy of results.

The reason for the greater present possibilities of machine figuring is that, as time goes on, time study is becoming more highly developed through the use of more scientific methods. The result has been that the carelessly set standards of former days have been supplanted in a large measure by labor standards which are constantly coming closer to the ideal, namely, rates which are fair to both management and employee. Obviously, a higher degree of accuracy is obtained at the expense of simplicity; a guess or mental estimate is replaced by mathematical analysis. Thus, the industrial engineer is warranted in using more significant figures than he did a few years ago, and it is this fact which has favored the use of the calculating machine.

In the determination of formulas and the analysis of time values in general, the most common expression of factors is a constant plus a variable time. If this variable is a first-degree function, the relationship may be expressed by a straight line, and if it is other than a first-degree term, the equation represents a curve. In any case, this condition is one which the time-study analyst encounters frequently, and machine computation furnishes him a means of quickly and accurately performing the necessary operations. Incidentally, the mathematical method of determining the equation most suitable for a series of plotted values is by the theory of least squares, and computations of this sort would be burdensome by any other method.

In using formulas or in figuring a rate from a time study, the result can usually be secured without taking any total out of the machine, that is without making any pencil notations or a mental note of any number. Take, for example, the procedure followed in establishing a standard time; a series of individual allowed times is totaled, and to this is added a percentage covering the allowances determined necessary. Either this value constitutes the rate (standard hours), or its reciprocal (standard production per hour), or a piece rate is set.

Again, in determining the allowed time for a suboperation, it is sometimes necessary to total a series of elapsed times and to discard or omit certain times, then to divide by the number of observations, and perhaps to apply a correction factor. With machine operation, a procedure like this involves almost no mental effort, and the human element with its possibilities of error is reduced to a minimum.

In following through an involved series of computations, it will be found convenient to keep the decimal point in the result at all times. Many cases are on record where the careless placing of a decimal point has caused serious inconvenience; the machine removes this possibility of error. Furthermore, accuracy is not limited to two or three significant figures.

Supply tracks at left with truck wheels, frames, brakes and other parts stored ready to be handled by locomotive crane to the progress track at the right

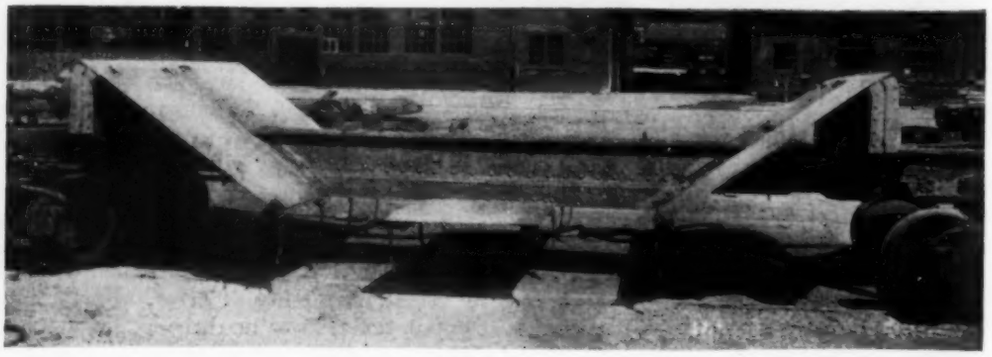
Hopper Cars while you wait

•

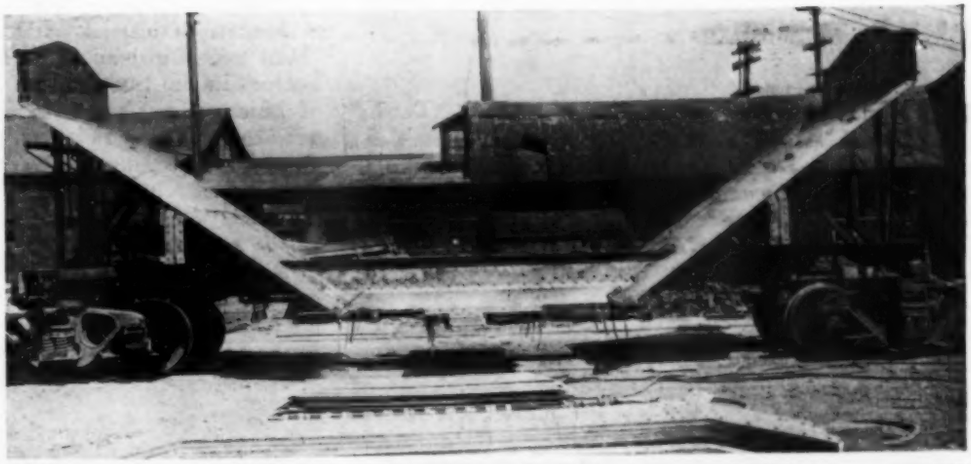
Photographs by courtesy of Norfolk & Western Roanoke Shops

•

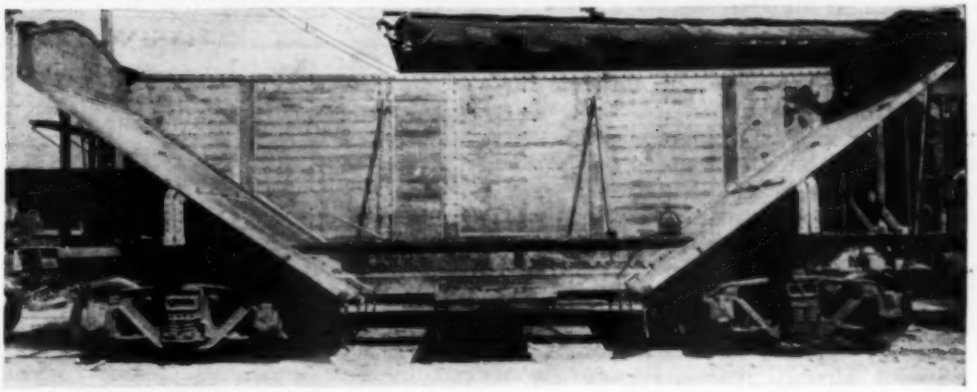
Steel center frame with end supports in place mounted on trucks. Air brake cylinders and rigging attached. End plates are stacked in the foreground



Lower plates of sloping ends erected. The opening between these and the center floor section is the opening left for the hoppers each side of the center



Upper sloping end sections mounted, these being previously riveted into units as seen in Fig. 1. End bracing in place over each truck



A built-up side sheet is now in position with two braces tying the side stresses due to load and preventing bulging of the sides

Inspection stand at end of assembly line. Air hoists are provided on each side of the elevated track to take the load from any car axle or spring. Brasses can be changed. By means of the levers shown, the load can be taken off the springs for inspection or replacement. Drop doors are placed in position by air jacks

A few rebuilt cars ready for the road as good as new. The first car was built in December, 1913, and has just been rebuilt. The wheels are of wrought steel

NEW BOOKS . . . . . .

MACHINE SHOP PRACTICE LABORATORY MANUAL—*By Alexander P. Gwiazdowski, M.E., assistant professor of shop practice, College of Engineering and Architecture, University of Michigan. 63 pages 6 x 9 in. Flexible imitation leather cover. Published by Barc Brothers, 2,200 East Forest Ave., Detroit, Michigan. Lot Prices.*

This book is one of the most practical manuals that have come to our attention. Supplemented by the detail and practical knowledge an instructor is supposed to have, the manual should give the student a good idea of what it is all about. If the instructor does not possess the necessary qualifications to supplement the information given in the manual, the student can nevertheless acquire a fair understanding.

The first illustration in the book is of a bench-type drill press. It requires nine different kinds of material to build this press. These materials, the tooling, set up, routing and machining operations necessary to manufacture this drill press, furnishes the continuity theme, as Hollywood has it, and instead of abstract principles we have a sequence of practical applications from ordering castings until the finished drill press stands before the student. The desire to "build" something is a powerful incentive for continued interest, which the method described furnishes.

From the classroom point of view the manual has the following characteristics. Reports are written in the machine shop. Grades are given in the shop in front of the student by writing them on the progress card inside the front cover. This makes for honest grades and is an incentive to better work. Finally, the report pages in the back of the book develop a sense of observation if they are filled in, and indicate its lack to the instructor if they are not.

BUSINESS ADMINISTRATION—*By Willis Wissler, Professor of Industrial Research, Ohio State University. 897 pages, 5¾x9 inches. Illustrated and indexed. Bound in cloth boards. Published by McGraw-Hill Book Company, 370 Seventh Ave., New York, N. Y. Price $5.00.*

The author avoids the common error of attempting to paint a still picture of that dynamic phenomenon we call business. In every chapter, he emphasizes the ever changing aspect of his subject. Further, he keeps before the reader that business, as a function of group psychology, is subject to all the vagaries and intricacies of human thought.

The book is long, but because of thorough treatment of the subject rather than because of extraneous verbiage. Professor Wissler has constructed his work to inspire independent thought in his reader. This he accomplishes by his interesting presentation and by a series of cues for discussion following the chapters. These cues are not the rather obvious questions frequently employed but extracts from speeches and writings by men, from Aristotle to Irving Fisher.

Following an introductory chapter on "The Contemporary Scene," the volume is divided into eight sections: "The Setting: Past and Present," "Pecuniary Control of Modern Industrial Order," "This Distributive Age," "Man and Management," "The Power Age," "Material Factors in the Stabilization Problem," "The Mechanics of Management," and "Social Consequences of Industrialism." These topics give some idea of the author's development of the relation of business to man, to capital, to technical advance, and to the State. The dwindling influence of the individual before the rise of group control is brought out.

While some may not agree with all Professor Wissler's conclusions, few can escape the stimulus to clear thinking his book invokes. It is well worth the attention of those interested in the shifting scenes of our modern business structure.

PURCHASING IN THE METALS INDUSTRY (DER EINKAUF IN DER METALLINDUSTRIE).—*By Dr. Berthold Buxbaum, head of the tool and machine tool purchasing department, German General Electric Company (Allgemeine Elektrizitäts Gesellschaft), Berlin. In the German language. 153 pages. Size about 6x8¼ in. 40 figures. Published in 1931 by the Society of German Engineers (VDI). Price RM 12.50 (about $3.00).*

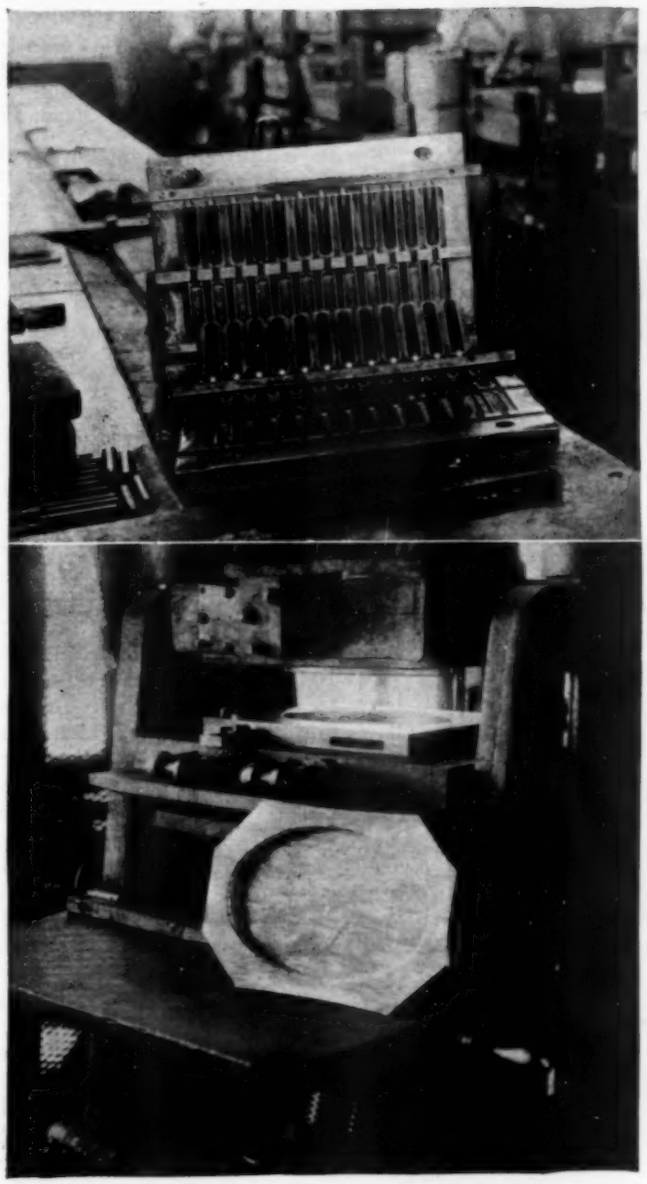
This book is a very thorough analysis of the problems confronting the purchasing agent in charge of buying tools and machine tools for a manufacturing concern in the metals working industry, more particularly one of large size. Objective consideration is given both to the standpoint of the purchaser and to that of the supplier and his representative, the salesman. Undesirable conditions frequently found to exist today on either side —and this applies to this country as well as to Germany— are criticised and valuable constructive suggestions are made to place the entire situation on a sounder basis by measurement of quality, applied either to the object itself or to its performance.

In emphasizing the general lack of a sound basis for the purchasing methods as now applied by the average concern and stressing the need for a fundamental change in this respect, the author says: "To these purchasing agents of the old school, liquid funds and the visible savings on direct expenses constitute the sole economic factor of importance, the equipment being something about which the workshop should worry, and human labor an item that is of no concern to them."

Among the suggestions made by the author to improve the general situation are the establishment of standard purchase specifications, if possible on a general basis under the procedure of the national standardizing body; closer contacts between the purchasing department and the other departments of the concern; continued checking by, and responsibility of the purchasing departments for the tools and equipment after they have been put into production; periodical conferences between representatives of the purchasing and production departments; centralization of purchasing to the maximum degree warranted by the special requirements of the organization concerned. The author's statements are illustrated by a number of interesting examples of methods adopted by his organization. The latter evidently has gone a long way towards a scientific solution of the problem of purchasing without, however, losing sight of its eminently practical aspects.

—JOHN GAILLARD,
Mechanical Engineer.

Working Nitro-Cellulose and other plastics



Top—Mold for forming pipe bits in Celluloid Corp. plant. Blanks made from drilled bar stock are shown in lower left corner. They are recessed at one end to receive the threaded bone insert and are heated on the steam table before being placed in the mold which is also heated

Cellulose-nitrate sheet up to 0.040 in. thick is formed in presses of this type after the stock is heated on a steam table. Dies usually remain in the press and are alternately heated by steam and then cooled by water after they are closed

Photographs by courtesy of the Celluloid Corporation

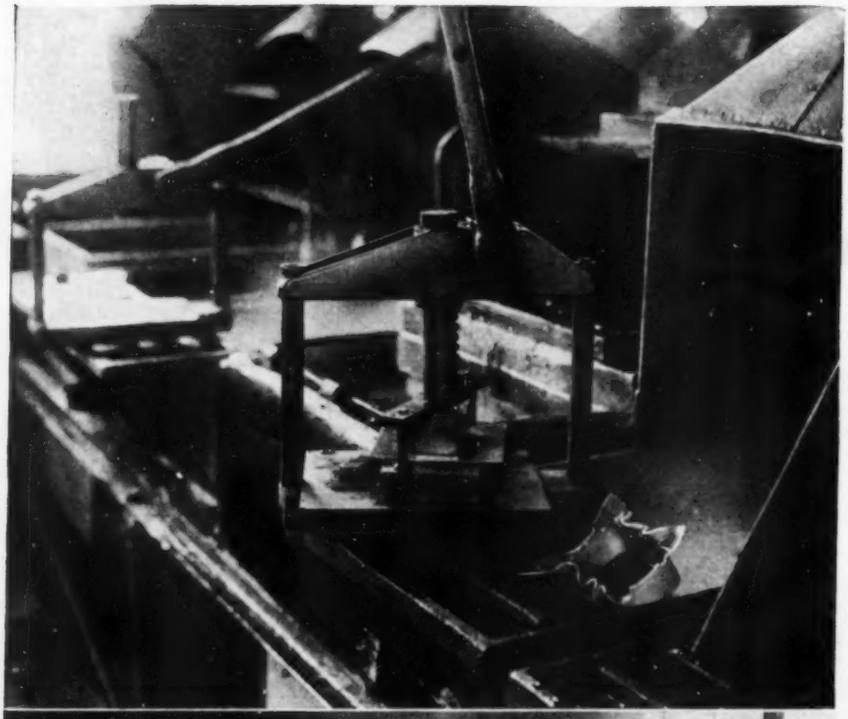
The second of two articles outlining modern methods employed in molding and machining non-metallic materials used in metal products

AMONG the widely used plastics is the pyroxylin group made from nitro-cellulose hardened with camphor, and sold under such names as Celluloid, Pyrolin and Amerith. Unlike the phenolic and urea resins and some other plastics, the nitro-cellulose type is not generally molded in powdered, chip, or granular form, partly because of its inflammability. It is a true thermoplastic, however, and is easily worked into a great variety of forms from the sheet, rod and tube stock in which it is furnished by the manufacturers. Scrap can be dissolved and reworked into a product which has about the same properties as the original stock, but seldom is made in light colors.

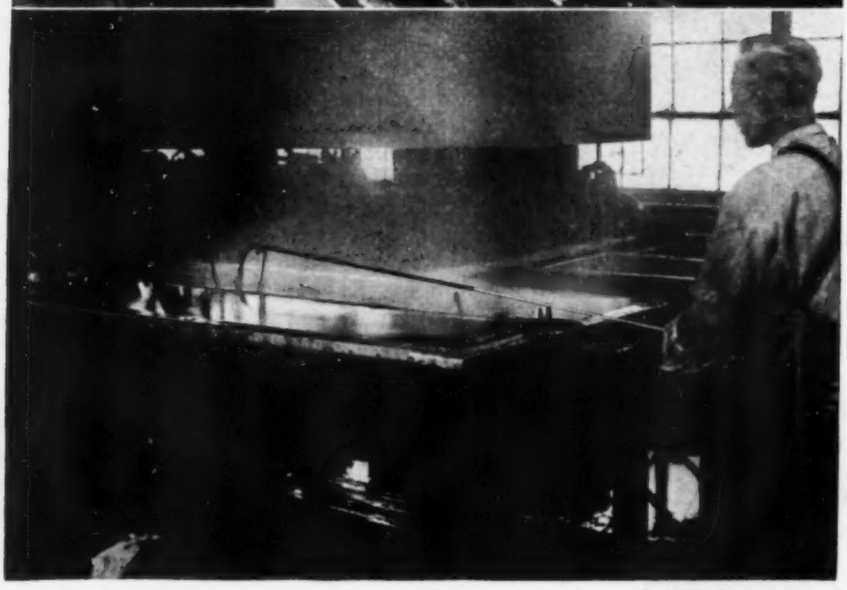
In appearance nitro-cellulose plastics resemble the cellulose acetate type but are somewhat less expensive on a pound basis. They are, however, much more inflammable, requiring care in working, in disposal of chips and scrap, and in storage.

Because they are adaptable to beautiful coloration in a great variety of transparent, translucent and opaque forms, and also because of their higher cost as compared to phenolic and urea plastics, nitro-cellulose plastics are used primarily where decorative effects are desired. They are employed extensively by the metal-working industry, however, but usually in combination with parts of metal, as in pens and pencils, cutlery and other handles, keys for office machines, mouth pieces, gear-shift lever knobs, instrument parts, rayon winding forms, coverings for bathroom hardware, and scores of other uses.

Ordinarily inserts are not molded into pyroxylin plastics unless the blank is first drilled to receive them, hence such molded parts are usually attached mechanically to metal or are cemented to it. Handles for scissors and other articles often are drilled after forming to receive the shank of the blade. In this case the shank may be heated in molten lead and then forced into the hole. The heat softens the material causing it to flow into depressions in the shank which thus is fastened securely. Nitro-cellulose tubing often is shrunk onto metal. The material is readily machined, blanked, ground or formed in other ways besides molding. Pigmented material usually is cut with tools of high-speed steel, and the softer trans-



Hand-operated presses are used for forming stock 0.040 to 0.110 in. thick. A sheet blank is clamped between the halves of the mold and lowered with the press into a sink of boiling water



When hot, the mold is closed and dropped into a tank of cold water Internal diameter of tubing is sized by slipping it over a rod or mandrel after heating in hot water. Mandrel and tube are next submerged in cold water and the tube is slipped off

parent material usually is cut with carbon steel tools.

A large proportion of molding work is done with sheet. This and other forms can be worked wet or dry. When water is used to heat the material it is kept at a temperature varying from 180 deg. F. up to the boiling point and the material is immersed until it reaches about the same temperature. When heated upon steam tables the steam pressure approximates 25 lb. per sq.in. or a temperature of about 265 deg. F. and blanks are heated to a temperature approximating 200 to 220 deg. F.

Several types of press equipment are employed, depending partly upon the relative shape and thickness of parts to be molded. In the Celluloid Corporation plant, where parts such as linotype keys and meter wheels as well as ornamental parts are to be shaped from blocks or tablets, the blanks and molds are heated on steam tables. When hot, molds are painted with a soap solution to prevent the pieces from sticking, the hot tablets are put into the mold, the latter is placed in a cold hydraulic press and quickly closed under a line pressure of about 2,500 lb. per sq.in. There the die remains for about ten minutes until thoroughly cooled. One workman handles several molds, each of which is placed in a separate small press, consequently he is kept busy during the cooling and heating periods.

Tablets for this and other classes of work are cut either from sheet or from bar stock with sharp-edged cutters. Since the outer surfaces of such tablets are case-hardened by previous treatment, the edges of tablets have to be rounded off to prevent flaws in the molded piece. Hence the tablets are tumbled wet with pumice and pebbles, wood blocks or other pieces of the material itself, to remove the sharp edges before molding. Large blanks sometimes are burred in a machine operation.

Characters on typewriter keys are made in two ways. When the quantity is fairly large, a raised character is engraved in the mold to make on the key a countersunk letter, which is filled afterward with paint. When the quantity is small, the character is cut from thin nonplastic sheet with a hand punch, is placed on the key by hand, being positioned temporarily with gum tragacanth. When in position these characters are pressed into the key in a mold which forces them down flush with the surface, making an inlaid character.

Articles of medium or heavy section to be molded in large quantities are formed in so-called automatic presses. In this case the molds have multiple cavities and remain in the press. They are cored for alternate heating by steam and cooling by water. Blanks previously cut to the approximate shape of the cavities can be preheated if desired or may be heated after they are placed in the mold. When at the correct temperature, the mold is closed under a pressure of about 2,500 lb. per sq.in., after which cold water is admitted to the cored openings.

When such molded parts are sufficiently cooled the mold is opened and parts are ejected and dropped into cold water.

Dies used in the operations just described are made from hardened steel when the quantity of parts to be produced is large. For smaller quantities, and especially where design changes are apt to be frequent, brass or bronze dies are employed. All molds are of the overflow type and leave a flash which is afterward broken or cut away. Usually the piece is ashed off with pumice and polished to remove mold marks. Necked pieces and those having recesses that would prevent their removal from a two-piece mold sometimes require that loose or split portions be incorporated in the mold.

Sheet stock up to 0.040 in. thick is formed in a process termed swaging. It consists of heating the stock on a steam table until it becomes as soft as very flexible leather and then placing it in a steam-heated mold which is immediately closed in a hydraulic press, and when closed is cooled by water circulation. This process is used for making boxes and similar objects requiring a fairly deep "draw."

Wet swaging is done on sheet stock from about 0.040 to 0.110 in. thick, chiefly in making deep drawn articles of fairly large size, especially where the quantity of pieces to be produced is small and where style changes and other factors are likely to change and render the mold obsolete. Molds used in this process are of brass or bronze and are held in a small hand press or clamp having a rack and pinion plunger resembling that in an arbor press.

Blanks used in wet swaging are not pre-heated, but are put into the hand press molds cold, being clamped between the two parts of the mold under light pressure. Press, mold, and blank then are dropped into a sink of hot water where they remain until the blank has become soft. They are then removed and the press is closed by hand, forming the piece to shape. The mold and press with the piece still in place then are placed in a sink of cold water until the piece has cooled enough to retain its shape, after which the mold is opened, the piece dropped into cold water, and the cycle repeated with a new blank. Ordinary pieces are produced by this method at the rate of 50 to 70 an hour. They are then delivered to sawing machines where the flash is removed. In the case of boxes in which the cover must be larger than the box itself by an amount equal to the thickness of the stock, two sheets are swaged simultaneously one inside the other. When completed, box and cover then fit together exactly.

Tubing used for the manufacture of pen barrels and caps and other tubular articles is made in an extrusion press. It is then straightened and sized by soaking in hot water, slipping it into a steel rod or mandrel and then plunging both rod and tube into cold water, after which the mandrel is withdrawn from the tube. Thereafter the outside diameter of the tube usually is sized on a centerless grinder. Both inside and outside diameters can be held by these means within 0.004 in. of nominal size.

Tubes sometimes are formed into non-cylindrical shape by a process termed "blowing" while they are held between the halves of a mold split vertically and placed in a press that closes the mold horizontally. Heating in this case is done by steam which is caused to flow through the tube under low pressure, the ends of the tube being clamped around steam inlet and outlet fittings. When the steam softens the tube sufficiently the mold is closed, and the steam pressure inside the tube forces its walls outward against the walls of the mold, giving the tube the desired shape. When the tube is thus formed the steam is shut off and the piece is cooled, after which it can be sawed into lengths, forming as many pieces as there are cavities in the mold. Blowing is done also in forming a great variety of hollow articles from thin sheet especially in multiple-cavity molds. In this process the sheets become soft enough to adhere to each other around the edges of the cavity, thus forming closed articles from which only the fins need be cut to finish the part.

Metal tubes or rods of circular and other sections can be covered permanently with nitro-cellulose tubing of almost any thickness by heating the latter in hot water, slipping it over the rod or tube, and then immersing both in cold water.

A large proportion of articles made from pyroxylin plastics are not molded, but are cut from sheet or rod stock and are shaped by machining. Edges are beveled by a router or formed cutter similar to that used in woodworking. Some parts are turned, drilled or otherwise hollowed out in a lathe. Rod is drilled to form pen barrels when the latter are not made from tubing. Some work, including threading, is done in automatic screw machines. Flat blanks are made in punch presses using sharp edge

Edges of celluloid blanks (handles cut from sheet in this case) are shaped on vertical-spindle routers, using formed cutters such as those shown. Air from a curved pipe blows chips into a receptacle having a sprinkler head as a precaution against fire

cutters. Rectangular blanks and some other work are cut on circular saws. Belt-type sanders are used for smoothing edges. In most cases where chips or shavings are formed, water or another coolant is employed or chips are discharged into water to reduce fire hazard. "Ashing" to remove tool marks is done on a soft cloth wheel using wet pumice, and polishing on a similar wheel using tripoli. Considered as a whole there is a marked similarity between the working of this stock.

Casein treated with formaldehyde, although known as a plastic material for nearly half a century, has been used commercially in this country in limited quantities until quite recent years. Efforts to mold this material in powdered or granular form have not been uniformly successful, partly because of trouble from cracking and warping.

At present casein plastics are produced chiefly in rod, sheet and tube form, from which they are worked mostly by machining, but to a limited extent by plastic forming under pressure after softening in hot water or hot oil. Being non-inflammable, the precautions against fire required with pyroxylin plastics are not necessary. The cost per pound of this material in sheet and rod form is somewhat less than that of most pyroxylin plastics.

Casein plastics are readily machined. They are softer and less resistant to moisture than phenolic and urea plastics, but lend themselves to beautiful coloration. For the latter reason their chief use at present is in ornamental objects such as buttons, parts made on screw machines, and in flat articles cut or stamped from sheet, but they are used to some extent for electrical parts, especially where color is a factor.

A plastic termed Victron, having a styrol base, has been developed recently. It is a colorless and transparent material but can be colored to almost any shade desired or compounded with fillers, and is chemically inert. This material lends itself readily to machining, is not brittle and can be molded at pressures as low as 300 to 500 lb. per sq.in. when heated to a temperature of 250 to 285 deg. F. It begins to soften at about 200 deg. F. Sheets can be softened and shaped after heating over a gas flame and joints can be made by heating until the material fuses.

A Special Control for Cutting and Traversing

A. G. BAUMGARTNER
Industrial Engineering Department, General Electric Company

AN AUTOMATIC lathe now on the market has a cycle which consists of a cutting operation with the motor running at 1,800 r.p.m., a rapid traversing operation with the motor running at 3,600 r.p.m., and a rest period. The 1,800-r.p.m. cutting operation requires about 5 hp., while the 3,600-r.p.m. traverse needs but 2 hp.

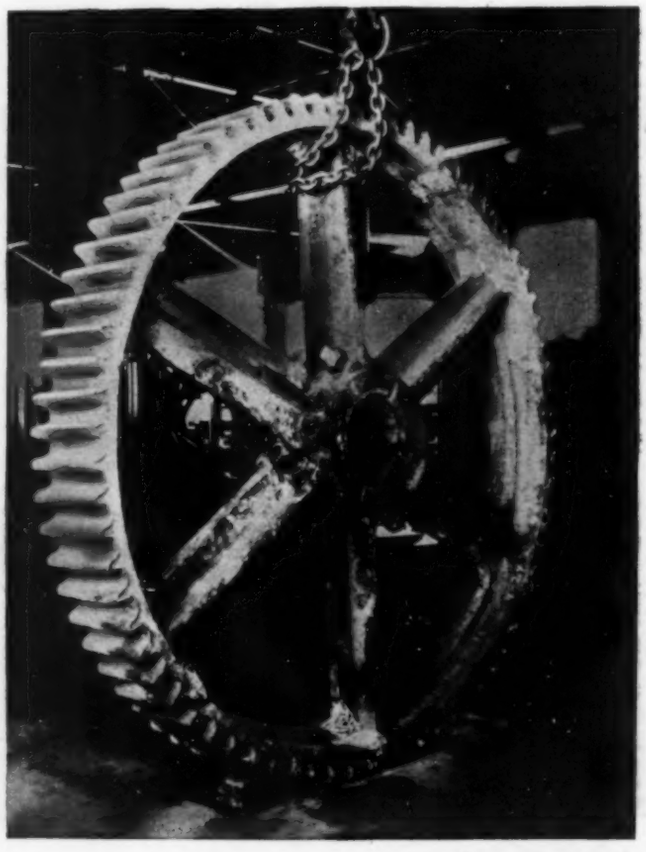
Two-speed motors were used originally on these machines with a 5-hp. rating at both speeds. Objectionable shocks to the transmission mechanism were experienced in starting and in transferring from one speed to the other because of the excess torque. These shocks were very destructive to the silent-chain drive, sprockets, and mechanism of the lathe itself.

The difficulty was remedied by introducing a two-winding motor and a special control arrangement. This motor is rated 5 hp. at 1,800 r.p.m. for the cutting or load portion of the cycle. The 3,600-r.p.m. winding has a rating of 2 hp., which is sufficient to take care of the light traversing load. By using the 2-hp. winding for the higher speed, the shock resulting from the transition from 1,800 to 3,600 r.p.m. is found to be negligible and requires no further special arrangement. To eliminate the shock experienced when shifting to the 5-hp. winding, Y-Delta starting is employed, which reduces the starting torque to one-third the normal value.

A time delay relay is energized at the same time the undervoltage device picks up. Closing a switch to start the cycle makes the Y connection and also de-energizes the relay. Because of the delayed drop-out of this relay, the Y connection remains sufficiently long to be effective. The delta connection follows and the cutting operation is under way. At the end of the cutting operation, the rapid traverse takes place on the high-speed winding bringing the machine back to its original condition. Two standard reversing contactors are used with the relay.

Proof of a Permanent Repair

A 9-FT. STEEL GEAR, weighing 6,000 lb. and costing over $1,000 new was repaired by arc-welding six years ago at a cost of $400 and is still in service. It is the main gear of a rock crusher in a cement mill, and was broken and cracked in several places, as indicated in the photograph. The Washington Iron Works, Sherman, Texas, repaired it with Lincoln equipment.



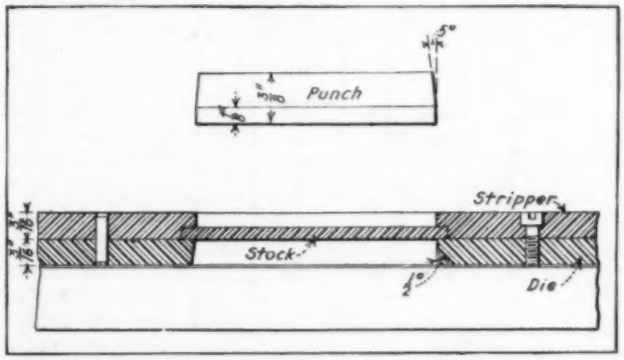
Ideas from PRACTICAL MEN

Blanking Tools for Experimental Purposes

CHARLES KUGLER

Just when the making of permanent blanking tools is warranted is sometimes a difficult problem, because of the many changes required in the perfecting of any device. Such changes have been the cause of scrapping many expensive tools. In one shop where I was employed, all experimental press tools were made as shown in the sketch, and the cost was not more than 25 per cent of that of permanent tools.

Tools of this type eliminate the use of the punch-holder, the die shoe, and the punch-pad. They can be used in any kind of press having sufficient power to blank the part wanted, and the die need not be fastened to the bolster. The material used to make tools of this type is generally gage stock for the die and the stripper,



but sometimes cold-rolled steel is used, being case-hardened. Cold-drawn steel is used for the punch. For blanking steel having a thickness of $\frac{1}{8}$ in., the thickness of the die and the stripper is about as shown in the sketch. Both the die and the stripper are clamped together and the opening is drilled and filed through both parts at one setting. Then the stripper is cut out to permit the stock to pass through it. The punch is given a clearance of 5 deg. to within about $\frac{1}{8}$ in. from the bottom, then it is filed or machined to fit the opening in the die. This method greatly reduces the cost, since about $\frac{1}{8}$ in. only of the punch must be fitted.

In operation, the punch is placed in the stripper opening on top of the stock and the tools are placed under the ram. After the punch has been driven through the stock by the press, the tools are removed and both the blank and the punch will fall into the operator's hand. It is obvious that the thin metal used in the lower members of these tools permits them to be made quickly and cheaply.

Editor's note. Numbers of such temporary press tools were in use in the Philadelphia Navy Yard in the manufacture of flying boats during the World War. Some of them were described in an article (AM—Vol. 51, pages 222 to 225).

Correct Shape of Index Pins and Notches
Discussion

U. SETH EBERHARDT
Works Manager, Newark Gear Cutting Machine Company

In the article (*AM*—Vol. 75 page 180), the arrow should show the disk running in the opposite direction. If the disk should run as shown in the diagram, it would turn past surface *B* until pin dropped in and hit surface *A* then the pin would force the disk back until surface *B* touched the pin thus making the disk turn backward every time it stopped which would cause a lot of trouble if there were any backlash in the mechanism.

When the disk turns in the direction opposite to that shown, the pin will start to slide down the taper on surface *A* until surface *B* is in contact. This type of notch has been used in spur gear cutting machines for about 50 years.

Setting Tools for Precision Boring
Discussion

DONALD RAEBURN
Glasgow, Scotland

In his discussion of the article under the title given above (*AM*—Vol. 74, page 622), Charles Kugler states that "independent of the condition of either the machine or the boring bar," setting the cutter in the way shown in his article, the hole will be correctly bored to size. With this statement I can hardly agree, since the condition of both the machine and the boring bar must play an important part in the setting of the cutter. I am assuming that the boring bar is supported behind the work by a steadyrest.

Looseness in the spindle bearings, or a sharp kink or a slight bend in the boring bar will nullify the setting

of the cutter during the boring operation; and these faults are often found in boring bars. After the spindle bearings of a horizontal boring machine have worn loose it will be found that when the cutter starts to cut it will have an eccentric movement instead of traveling in a true circle, hence the hole will not only not be round but will be larger than would be expected from the setting of the cutter. The amount of error will be dependent upon the condition of the spindle bearings and the distance of the steadyrest from the cutter.

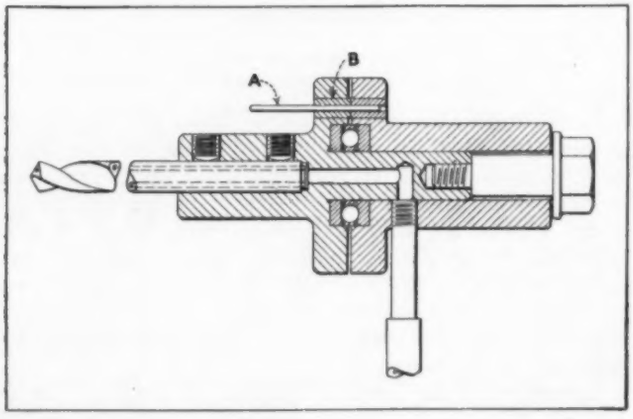
Where the boring bar has been slightly sprung, or has a sharp kink, and the steadyrest cannot be set to avoid this part of the bar, the finished hole will not be correct. To show the error caused by loose spindle bearings, let Mr. Kugler bore a hole 0.010 in. less than finished size, then make two double-end cutters, one 0.003 in. less than finished size, the other to be right up to size. Set the undersize cutter in the bar correctly; that is, to bore 0.003 in less than finished size; and so that it will have a side-floating movement. After this cutter has passed through the hole, insert the full-size cutter, which must also float while boring. Observing the action of both cutters will prove instructive and will emphasize the following statement by Ernest Foldvary (*AM*—Vol. 74, page 26): "providing the boring machine is in good condition and the boring bar is properly adjusted in its bearings."

Mr. Kugler suggests that Mr. Foldvary's method can be applied under ideal conditions only. As an experiment, set up a piece of work for boring, and with rigid steadyrests on each side of the work, and with the boring bar supported in good bushings held in the steadyrest, finish the work. With the cutter set as indicated by Mr. Foldvary, the result will justify the experiment and will also show the possibilities of good work with comparatively poor equipment.

Drill Holder for Deep Drilling

JOHN B. WALSH
Foreman, Mergenthaler Linotype Company

We had considerable trouble in drilling holes $\frac{1}{2}$ in. in diameter and 12 in. deep in $\frac{7}{8}$-in. round Invar stock, an alloy high in nickel. The work was done with a commercial high-speed drill 12 in. overall and 9-in. length of flutes. The drill had lubricant holes running its full length, the necessary piping being connected to a tapped hole in the shank. The breakage of drills was high, because of the nature of the material and the length of the drill, which was weakened by the lubricant holes. The length of the flutes was cut down to 4 in., and while this did reduce the breakage some, it was still too high. Straight-fluted, or gun-drills, could not be used, as the cutting edges did not have enough rake.

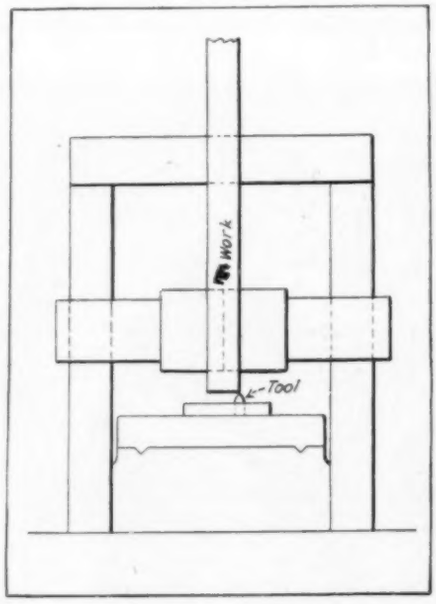


The drill holder shown in the illustration was then designed and made. It was equipped with a shearing pin, which was the means of saving considerable money in drills. The lower member, or drill holder, has a stem that is a running fit in the upper member, of shank. Between the flanges of the two members is a ball thrust-bearing for taking the thrust when pressure is applied to the drill; also to slightly separate the flanges. Both flanges are connected by the shearing pin *A*, which is a sliding fit in the hardened bushings *B*, the bushings being in line for the easy insertion of the pin. Before the torque reached a point that would break the drill, the pin would shear, thus saving the drill.

It was found that a soft-steel shearing pin $\frac{1}{16}$ in. in diameter and located 1 in. from the center of the holder was correct for the size and type of drill used. Holders of this type can be used for drills of different diameters and lengths either by varying the diameter of the shearing pin, or changing its distance from the center of the holder.

Handling Oversize Work on the Planer
Discussion

HARRY SHAW
Consulting Engineer, Heywood, England



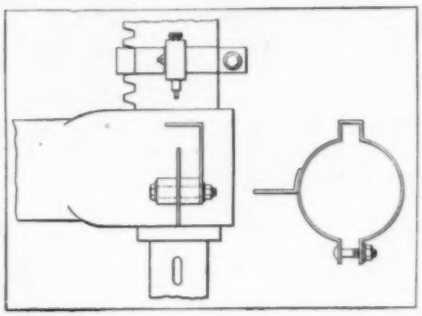
While the method described by W. B. Lincoln, Jr., in an article under the title given above (*AM*—Vol. 74, page 694) is no doubt novel, my objections to it are that since the tool bar is 36 in. long, it cannot be very rigid, and that a special cast-iron base piece is required to support the tool bar. I would much prefer to employ the old method of supporting the work on blocks on the floor, holding the tool in a carriage taken from a lathe and mounted on an angle plate bolted to the planer table. Then the tool would move while the heavy piece of work would be stationary—a far better state of affairs. Sometimes one of the side heads can be taken from the planer and be fastened to the table.

Some good work has been done on the ends of long pieces by holding the tool on the table and securing the work to the saddles, as indicated in the sketch. The

work can then be fed across the tool by the feed screw in the cross-rail. Sufficient head room must, of course, be available.

A Micrometer Stop for the Drill Press *Discussion*

ROBERT S. ALEXANDER



Referring to the article by A. J. Wormwood, under the title given above (*AM*—Vol. 74, page 768), I have used a method of obtaining accuracy in counterboring and other precision operations that is less expensive than the stop described by Mr. Wormwood, yet it compares favorably with any stop I have seen.

A dial gage is attached to the spindle quill by a clamping ring, as shown in the illustration. The gage contacts with a piece of thin flat stock bent to a right angle and held by the screw that tightens the bearing on the quill. In setting the gage, the cutting tool is brought to bear upon a finished piece of work, or upon gage blocks of the correct height. The indicator is then set to zero, the contact point of the gage resting lightly on the bent stop.

The counterbore is then fed into the work until the indicator registers zero, when the tool will have cut to the required depth. This device can be used in repetitive work, or for removing a fixed amount of metal from parts of odd thicknesses, thus assuring accuracy within close limits.

An Improvised Method of Making Helical Cams—*Discussion*

A. WILLIAMS
Estimator and Chief Ratefixer,
Bristol Motor Constructional Works, Bristol, England

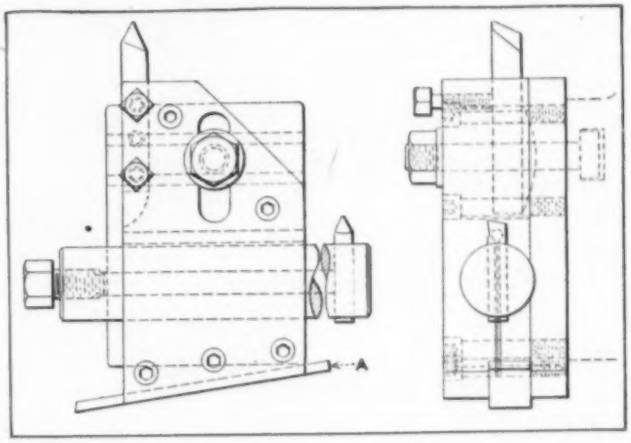
In a contribution to the discussion of the article by George Belbes, under the title given above (*AM*—Vol. 74, page 365), Charles Kugler (Vol. 74, page 803) states that "Since the layout on the paper is much larger than the cams, any inaccuracy in the layout will be reduced in the cams." The matter contained in this statement has recently been the subject of a hot debate between a colleague and myself, my contention being that the inaccuracy is reduced in its dimensions only, but not in its effects.

Inaccuracy is comparative, and if by the methods shown, the dimension of the inaccuracy is reduced, it still remains in the same proportion to the size of the cam. The advantage of a large projection lies in the fact that the inaccuracies are much more apparent and therefore are more readily corrected, but it is essential that any corrections should be made on the large projection.

A Combination Toolholder

WM. C. BETZ
Master Mechanic,
The Fafnir Bearing Company

To prevent the breaking out of the T-slots in lathe toolblocks, and to eliminate the necessity for a great quantity of toolholders, the combination toolholder shown in the illustration was designed. It is held in the T-slot of the toolblock by a bolt around which it can be swung into any position necessary to bring the various tools into cutting position. The turning tools can be adjusted for height by the conventional rocker. A hole is bored for the insertion of a boring bar, various small sizes of which can be used by bushing the hole. The cutting-off tool *A* is simply a blade and can be sharpened by grinding the end. It is clamped by the same screws that clamp the boring bar. When the cutting-off tool is to be used, the boring bar must, of course, be removed, both to get it out of the way and to insure the necessary clamping action for the cutting-off tool.



Boring Die-Sets for Leader Pins *Discussion*

H. ROSE
London, England

In an article under the title given above (*AM*—Vol. 74, page 587), C. Archbold describes a method of boring the leader-pin holes in pillar press tools. While quite capable of producing a good job, his method has the disadvantage of requiring special fixtures. Also, it appears to be rather slow. For instance, at least four clamps are necessary to hold the parts, each of which has to be twice set in position on the faceplate before the boring operation can be completed. Balancing is also essential, since the whole weight of the work is on one side of the spindle.

From my experience, the better machine in which to do the job is a vertical-spindle milling machine. My next choice would be a horizontal milling machine equipped with an angle plate on which to mount the work. Both halves of the work should be first planed on the tops and the bottoms, and then clamped together on the machine table with parallels between the inner faces. With such a set-up, both leader-pin holes can be drilled, bored, and reamed with tools held in the machine spindle

without dismantling the set-up after the first hole has been finished. And this can be done with the assurance that both holes will be in accurate alignment.

If both holes are drilled before any boring or reaming is done, the possibility of inaccuracy arising through the work slipping while drilling the second hole will be eliminated. This procedure is our usual one, and if the work has been clamped securely it will not be found necessary, even as a precautionary measure, to fit a leader pin before finishing the second hole.

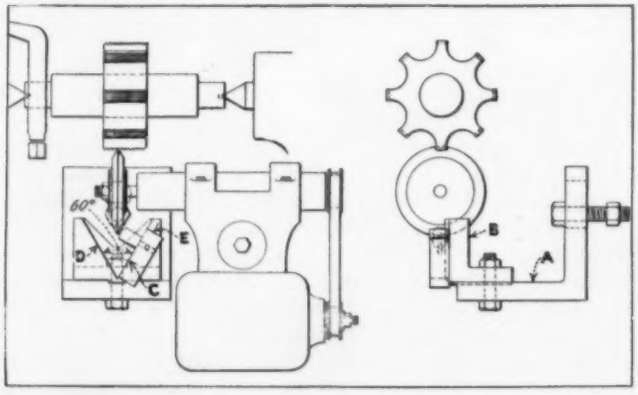
When dealing with pillar tools of the compound, circular-die type, it is essential that the recesses previously bored for locating the punch and the die should be in line after the leader pins have been fitted. Therefore, the recesses must be accurately located with reference to each other before boring for the leader pins. To locate them accurately, instead of the parallels used in the previously described set-up, a cylindrical plug should be used. Its diameter at both ends should be such as to be a light press fit in each recess. The ends of the plug should, of course, be faced parallel with each other. With this plug in position between the two halves of the work, the holes can be bored as before, correct alignment throughout being assured.

Grinding Tap Threads in an Emergency

JOE WOLTERMAN

The general practice in our plant is to purchase all taps with ground threads. Recently, we needed a new tap in a hurry. Since we could not wait until it could be delivered, it was necessary to make it in the tool-room.

Using a 16-in. tool-room lathe equipped with a relieving attachment, we mounted a motor-driven grinder on the compound rest. For truing the wheel to the required 60 deg. included angle, the two angle plates *A* and *B* were mounted on one of the wings of the carriage. Angle plate *B* was aligned by a tongue fitting in a slot in angle plate *A*. Part of the top surface of angle plate *B* was cut away, leaving ledges about $\frac{1}{4}$ in. high and forming an included angle of 60 deg. at *C* and *D*. Block *E* carries the diamond for truing the wheel, and is alternately held against the ledges *C* and *D* by the left hand, while the wheel is brought against the diamond by operating the cross-feed screw with the right hand. Keeping the block *E* in contact with one of the ledges and sliding it backward and forward causes the diamond to true one side of the wheel. The other side is trued by placing the block against the adjoining ledge and repeating the former procedure. With the wheel thus trued, the grinding was done by the usual method.



SEEN AND HEARD

JOHN R. GODFREY

Anti-Scrapers in 1863

Agitation as to the necessity for scraped surfaces dates back further than I knew about. One of our Scotch friends sends a quotation from the *Scientific American* of 1863 that, except for language and length, might have been written by a much more recent doubter as to the advisability, or necessity, of all the scraping being done even now. To quote my old friend, Oberlin Smith, "it is astonishing how frequently the ancients copied our inventions," which seems a more subtle way of expressing it than that there is nothing new under the sun.

Setting Sensible Tolerances

There are probably many opportunities for improvement in the practices of any shop and always will be. But no matter how far we progress there will always be room for a lot of old fashioned, or new fashioned, horse sense. It is a commodity that pays big dividends but isn't always recognized as well as it should be. A case in point was the drilling of a large number of holes in a 6 ft. steel disk, the spacing of which was supposed to be very accurate, a most indefinite term. The draftsman put on a tolerance of two thousandths, but the workman asked for three. Then the common sense artist came along, figured the expansion and contraction of the disk at a 20-deg. temperature variation and put the tolerance ot four thousandths. The disk came out O.K. and everybody was happy. As long as metal doesn't stay put, for various reasons, it is a good plan to watch tolerances with an eye on the liberal side.

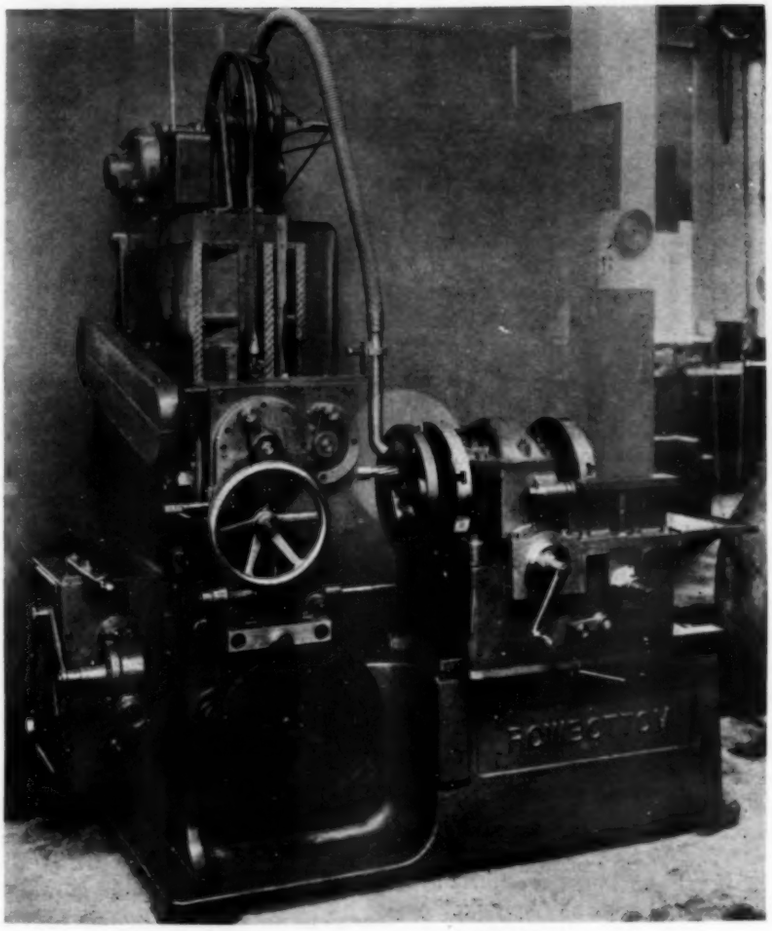
Simplification Saves Ten Million

Waste elimination, by standardization and by simplification, is always a problem to be carefully considered. The engineer of one large company recently told me that a simplification program started by the Department of Commerce has saved his company ten million dollars in a single year. Russia is making use of our experience and reports a saving of $50,000 and 100 tons of metal by standardizing pins, hooks and eyes. Real improvement is always in order but it pays to stick to one standard until we get a better one.

Checking and Chucking Chucks

Chucks and other small tools or accessories sometimes muss up one's ideas on cost keeping and obsolescence. Some consider the drill chuck as part of the machine while others call it a tool and check it in and out of the toolcrib as with the drills used. This seems to involve a lot of unnecessary work and might also affect the accuracy of the chuck on the spindle. Some put chucks in the tool account instead of the capital account, considering them a supply, as in the case of drills. The main thing is to keep them in order and to scrap or repair them before they harm the work.

SHOP EQUIPMENT NEWS



Arrangement for drum or side cam cutting

Rowbottom Model 300 Universal Cam Milling Machine

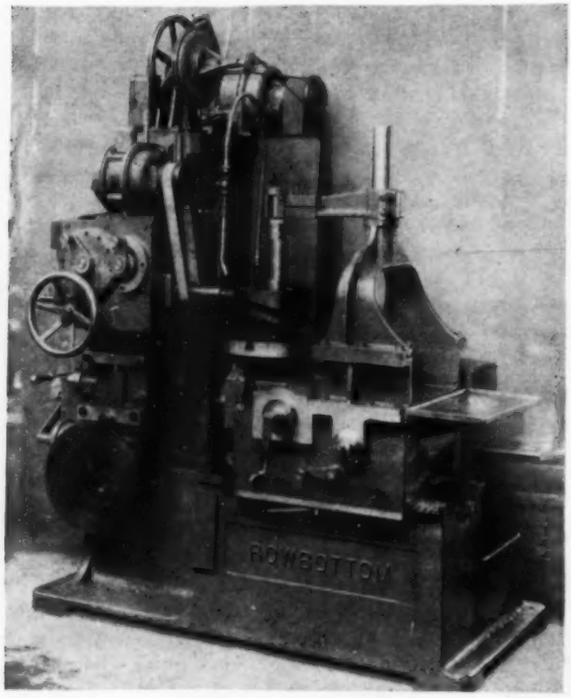
A new model universal cam milling machine is being manufactured by the Rowbottom Machine Co., Waterbury, Conn. This machine uses the former-follower system as did previous units with formers made from cast-iron plates ½ in. thick and ranging in diameter from 8 to 28 in., depending upon steepness of rises and falls of actual cam layout. The capacity of cams handled conveniently is: Box cams up to 32 in. outside diameter, face cams up to 28 in. diameter and barrel cams up to 24 in. diameter with a travel, or throw, up to 12 in. Larger sizes can be handled by special handling and fixtures.

The machine is driven by a 3-hp. motor, belted to a swinging gear box, from which the cutter spindle and workhead drives are separated. The cutter spindle, Timken-mounted, is driven by silent chain to the gear box in the cutter slide, giving eight separate speeds, 50, 75, 100, 128, 150, 230, 300 and 384 r.p.m., through hardened steel quick-change gears running in a bath of oil. Spindle direction can be reversed by a sliding gear in the swinging gear box at the rear, which allows right- or left-hand cutters to be used.

The workhead is adapted to either barrel or face and box cams by rotating on trunnions to bring the axis of the work spindle either in a vertical or horizontal position, and is driven by a belt from the swinging shaft to the worm shaft bracket on the back of the feed gear box. A shear pin is inserted ahead of the gear train to save the gears from breakage through accident or overload. These gears, like those of the cutter-spindle gear box are of the quick-change type, and give nine changes of feed—2, 4, 5½, 7, 9, 14, 20, 26 and 32 min. per revolution of work.

The former spindle is positively driven through worm and wormwheel by the back shaft which is connected with the feed by a starting clutch lever. The position of the clutch lever on the gear box determines forward and reverse direction of the work and former. The workhead is moved to and from the cutter by a crank handle equipped with a micrometer dial for correctly setting the dept of cut. For cast-iron cams, a blower mounted on a motor plate furnishes the air for cooling and keeping the cutter free from chips. Another pipe and pump connected with the tank in the bed furnishes lubricant when cutting steel cams. A hose and nozzle with proper catch pans are supplied also.

This machine can be furnished as a combination milling and grinding machine. To use as a cam grinder, it is necessary to mount a motor bracket with a 1-hp. motor on top of the cutter slide and change the feed driving bracket in the rear for one specially adapted for grinding speeds. The grinding spindle is mounted on an arbor with a taper shank fitting the hole in the cutter spindle and is driven directly by a belt from the motor mounted above. The cutter spindle is disengaged from the drive by a sliding gear and remains stationary when grinding. The same



The Rowbottom Universal Cam Milling Machine arranged for grinding with a 1-hp. motor mounted on the top of the cutter slide

master former is used for grinding that is used for the milling operation, and a change from one to the other requires about 30 minutes.

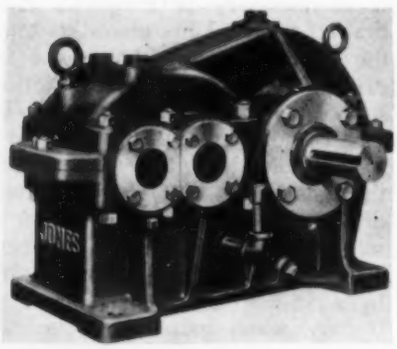
Jones 90-D and 105-D Herringbone-Maag Speed Reducers

A series of double-reduction Herringbone-Maag speed reducers for small motor drives has been designed by the W. A. Jones Foundry & Machine Co., 4401 Roosevelt Road, Chicago, Ill. In design, construction and manufacture, these small machines are the same as the heavy-duty reducers of this company.

Double helical gears, generated right and left hand, in effect a herringbone gear with a wide gap, are used for the initial, or high-speed, reduction. The low-speed reduction consists of a Maag pinion and gear. Timken bearings are used throughout, assuring antifriction mounting. The pinions are of heat-treated alloy steel and gears are of high-carbon forged steel.

All style No. 1 reducers are intended for torque drives through flexible couplings on both high and low speed shafts. The shaft diameters and bearing sizes are selected accordingly, since the majority of applications require coupled units. For overhung loads applied to the low-speed shaft, the machines are listed as style No. 4. For this service they are arranged with slightly larger gear shafts and also with bearings of greater capacity than those furnished for the style No. 1 unit. Reducers in style No. 2 are furnished with the low-speed shaft extended and supported by a pedestal equipped with a roller bearing. These machines are intended for use with a sprocket or pinion assembled directly on the shaft between the reducer and outboard bearing.

An extensive list of ratios is carried in stock to insure prompt deliveries. Horsepower ratings vary from .9 to 2.8 for the 72-1 ratio unit, and from 5.2 to 8 for the 12-1 ratio unit, horsepower rating varying with the speed.

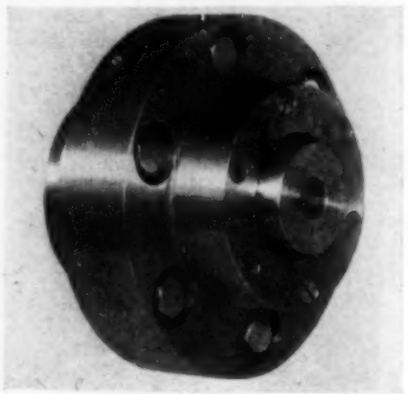


Allen-Bradley Splash-Proof Starter for Squirrel Cage Motors

The Allen-Bradley Company, 1311 S. First St., Milwaukee, Wis., has announced the Bull. 710 WT across-the-line starting switch for use in places where a splash-proof starter is necessary. The starters are rated for squirrel-cage motors up to and including 100 hp., 220 volts, and 200 hp., 440-550 volts. On slip-ring motors they serve to control the primary circuit up to and including the maximum rating listed for squirrel-cage motors. If the thermal relay reset button is omitted from the side of the cabinet, this starter is entirely watertight.

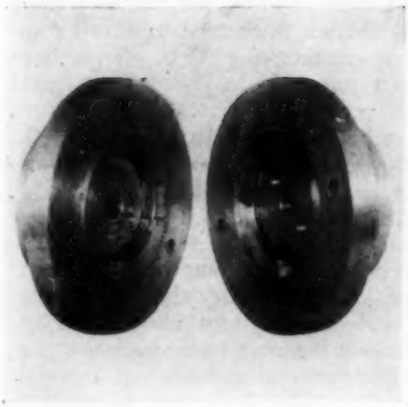
Davis Flexible Coupling

A type of flexible coupling containing no springs, gears, bushings or perishable washers is being manufactured by the Penn Machine Co., Johnstown, Pa. The coupling embodies the principle of ball and socket motion. Hardened and ground socket keys sliding in keyways cut in the outer ring fit over balls imbedded in



the hub and permit the coupling to compensate for misalignment.

The outer ring connects the two hubs, no matter what position they may be in, through the socket keys sliding endwise in the ring and rocking over the imbedded balls in the hubs. There is no change in the contact area whether the coupling is working under perfect conditions or extreme misalignment, since almost half the area of the balls is always in contact in the socket keys. All couplings are designed for extreme misalignment; the smallest sizes permit $\frac{1}{16}$ in. offset and 6 deg. angular misalignment, increasing with the coupling sizes up to $\frac{1}{4}$ in. offset misalignment. The number of imbedded balls and sliding socket keys is controlled by the size of the coupling. In the smaller sizes, three in each hub are provided, while larger sizes have a proportionally larger number. The couplings are made entirely of high-



Hob, socket keys and outer ring in each Davis half coupling are held in position by a lock wire which fits in a groove in the outer ring. This wire keeps each half couping intact while the coupling is being installed

carbon forged steel with case-hardened and ground balls and socket keys. Couplings are available for every type of drive and load condition. Both shrouded and exposed type couplings are manufactured. Couplings to meet unusual operating conditions can be furnished.

A feature of the coupling construction, according to the manufacturer, is the ease with which it is installed. The hub, socket keys and outer ring in each half coupling are held in position by a lock wire which fits in a groove in the outer ring. This wire has no other function than to keep each half coupling intact as a unit while the coupling is being installed. Lubrication is performed through an oil filling plug on the outer ring. When the coupling is in operation all moving parts operate in a bath of oil, circulated to the points under load by centrifugal force.

AMSCO Manganese Steel Welding Rod

A new welding rod, used in the repair of manganese steel castings and in the reclamation of such manganese steel equipment as dipper teeth, crusher mantles and jaws, railway track members, etc., is being manufactured by the American Manganese Steel Co., Inc., Chicago Heights, Ill., following the recent issue of patent 1,815,464.

The welding rod is of a composition designed to permit the rod to attain the essential features of standard heat-treated manganese steel through air hardening alone. The high nickel content of approximately 5 per cent overcomes any tendency of the metallic manganese content of the rod to oxidize and prevents embrittlement under slow cooling, which the rather high carbon content might cause in the absence of the high nickel content.

The patent claims as granted are very broad, covering ranges as follows:

Iron	90.00% to 25.00%
Manganese	5.00% to 25.00%
Carbon	0.50% to 2.00%
Nickel	0.25% to 50.00%

The preferred formula designated as "A" in the patent is as follows:

Iron, about	80.00%
Manganese	14.00%
Carbon	1.30%
Nickel	5.00%
Silicon	0.35%

This rod, according to the company, is the result of research work done at the Chicago Heights plant during the past several years in search for a welding rod that would leave a deposit equivalent in analysis and physical properties to heat-treated manganese steel, that could be used by any fairly competent welder with the electric arc with good results, and that would not require special heat-treating or quenching. The material is available in the usual range of sizes.

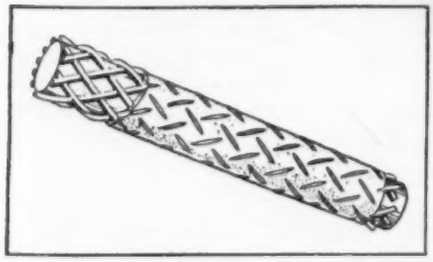
Alemite Model PA-400 Giant Pneumatic Compressor

A system of centralized lubrication for all machines in a plant has been worked out by the Alemite Corp., a division of Stewart-Warner, 2650 No. Crawford Ave., Chicago, Ill. The system incorporates a lubrication compressor or reservoir of 410 lb. capacity and capable of delivering lubricants throughout a shop. The system consists of a lubrication compressor or reservoir, a pump with the necessary valves and fittings, and the pipe lines. The compressor is air-operated and requires from 40 to 100 lb. per sq.in. pressure. In operation, air is delivered through a regulator valve at the top of the compressor. By the use of a four-way valve, the air is first drawn from the bottom of the tank, under the follower, allowing the follower to drop to the bottom of the compressor. The hand-wheel is then opened and the lubricant dumped into the reservoir. The power is then applied, making the high-pressure lubricant available anywhere it is piped. Outlets can be conveniently located. A 20-ft. flexible, high-pressure hose can be applied, enabling lubrication of any bearing within the radius of a 40-ft. circle by simply attaching the hose coupling to the Alemite fitting on the bearing. A release valve in the hose line permits the operator to give every bearing individual attention and also to control the amount of lubricant put into the bearing.

Lubrication compressor and pump assembly. The lubricant supply line is the larger pipe at the left

"Woven" Fluxed, Wire-Wrapped Welding Rod

An electrode or welding rod, consisting of a base or solid core which has woven thereon a plurality of strands of fine wire, and with the intersticial pockets filled with an arc-sustaining or slag-producing flux, is being manufactured by the Woven Welding Wire Co., 123-125 Hawthorne St., Roselle Park, N. J. This



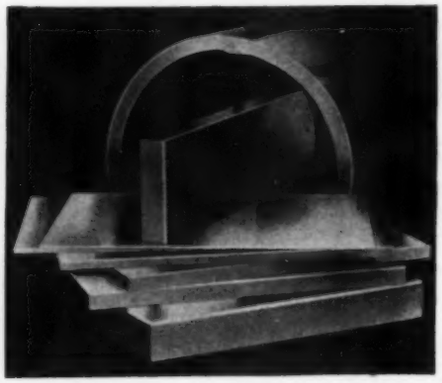
method of construction permits varied metallurgical combinations, plus the means of fluxing to a point whereby this essential element or factor is keyed to the base material. It is possible to obtain practically any alloy combination by simply varying the metal used in the weave. The weave also aids in holding the flux.

Coating or flux thickness, which has a bearing on the ultimate weld result as to elongation, ductility and tensile strength, may be varied through the use of smaller or larger diameter weave. In the case of low and medium carbon steels, welds may be obtained that will have an elongation of 25 to 30 per cent in two inches. The unusual construction of this wire also permits its use in an automatic welding machine, since the woven wire surface of the rod is always in contact with the feed rollers and conducts current to the rod itself.

The manufacturer claims to have been successful in producing welds of tungsten carbide, having a Rockwell hardness of 69 on the C scale, this being a combination of high-carbon and tungsten-woven welding stock.

"Plykrome" Composite Steel with Stainless Surface

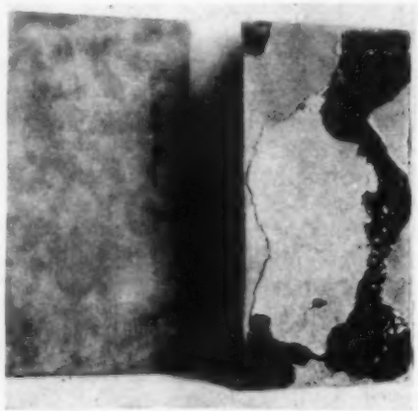
The cost of the so-called stainless steels has been a partial handicap in their application, particularly to the larger fabrications where heavy plates are required. For that reason, Industrial Welded Alloys, Inc., 225



"Plykrome" composite steel

Broadway, New York City, began in 1927 to create stainless steel linings for tanks and other equipment, to effect maximum economy of the metal. An extensive period of research culminated in "Plykrome," a composite metal in which the stainless steel is veneered and completely weld-bonded to a mild steel slab.

Oxidation, the great detriment to welding, was prevented and the weld between the two plates has been constructed to permit expansion of the alloy under increased temperature without breaking its bond with the steel. The metal can be handled, bent, drawn, spun or flanged without cracking or parting the alloy from the steel. The ratio of alloy thickness to that of the sheet or plate can be anything desired, the plate having been made with 0.010 gage steel strip with an alloy ply of 0.00125 in. Present practice is to recommend a ratio of approximately 1:15 as offering greatest economy. In the case of heavy pressure vessels where 1-in. plate or a greater thickness may be required, the ratio may be 1:30.



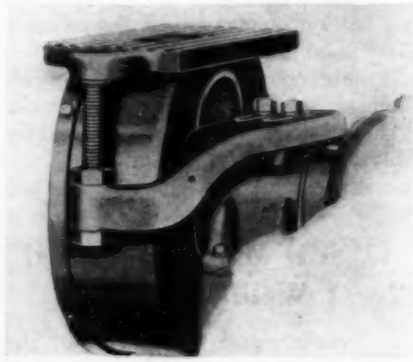
"Plykrome" face, and backing face repeatedly heated to 1,600 deg. F., and cooled. The ply face is unaffected

Unlike plating, the thinnest alloy ply surface is claimed to afford complete protection. Test vessels have been subjected to boiling nitric acid for periods up to 150 hours with a conclusive demonstration that the alloy surface was completely homogeneous. The metal can be made with the stainless ply surface on one side, or both. The increased ultimate strength of the composite product is considerably greater than the proportionate thickness of alloy ply. One series of recent tests disclosed that, while the total thickness of the plate was increased 7 per cent by applying a veneer of alloy, the ultimate strength was increased 25 per cent.

In the making of Plykrome a plate of the stainless alloy is welded to the steel slab, billet or bloom, before rolling. It is then rolled in accordance with usual mill practice into plates, bars, sheets, etc. The alloy surface is then sandblasted, pickled or polished depending on the use for which it is intended. The new composite metal has been and can be produced with its stainless alloy component of any analysis.

"Hisey" Surface Grinding Attachment

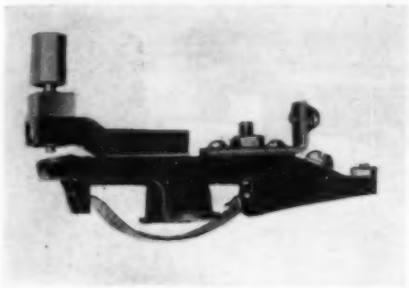
A surface grinding attachment which, as a complete unit, is interchangeable with standard wheel guard equipment, and can be mounted on either right or left side of the ma-



chine, is being marketed by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The table is adjusted to wheel wear by two square-thread screws locked in place by means of two opposed nuts. The guard cover is readily removable for replacement. Both guard and cover are constructed of steel. The table, 10x21 in., is self-cleaning.

Robbins & Myers 1,000-Watt A. C. Thermostatic Snap Switch

A positive snap action 1,000-watt a.c. capacity thermostatic switch for thermostatically controlled heating appliances is announced by Robbins & Myers, Inc., Springfield, Ohio.

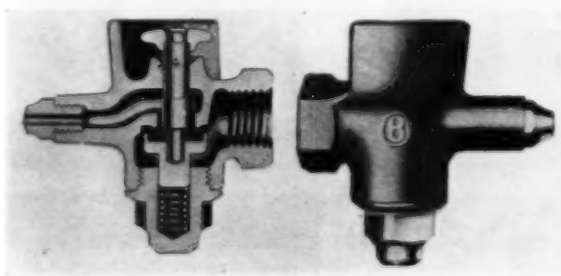


The switch maintains any desired temperature over a total heat range from atmospheric temperature to 525 deg. F. with a maximum variation of 5 deg. A special low-temperature type thermostatic snap switch to maintain temperature with a differential of but 2 deg. is also being placed on the market.

The switch stresses simplicity, compactness of construction and long life. It has but two moving parts, with resultantly greater durability and more dependable performance. It occupies from ⅓ to ½ less space than the ordinary snap switch, and the circuit-breaking spring is of a special steel. The switch is designed for easy application. It may be installed as part of the final assembly job, and can be made either to open or close with temperature increase.

Ohio Blow Gun Valve

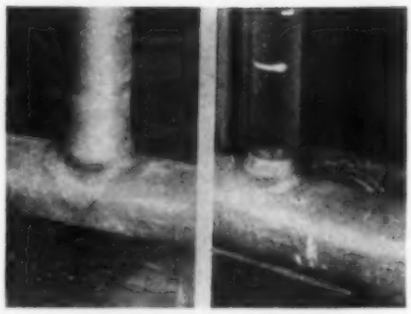
Experience in its own shops and foundries prompted the Ohio Brass Co., Mansfield, Ohio, to seek some design of blow gun which would conserve air and reduce maintenance expense and production delays. Such a blow gun is now being offered to the trade. Leakage, either through accidental opening or failure to shut tight, is avoided. A heavy flange of metal surrounds and protects the thumb button, insuring against damage from rough use and making opening impossible, except when desired by the operator. The disk is of a special soft composition and fits against a machined seat, where it is held in positive contact by a spring as well as by the pressure of the air itself. Much of the trouble and inconvenience of renewing disks is eliminated, since the stem of the valve will not slip out when the cap is removed. Ample air capacity is provided by the ducts and the size of the opening. The threaded end has an unusual amount of pipe clearance. The valve is regularly furnished with female threads in ¼- and ⅜-in. sizes, but male threads may be had if desired.



Bonney Weldolets and Thredolets

To meet the demand from the welding industry for a satisfactory method of making welded T-junctions, the Bonney Forge & Tool Works, Allentown, Pa., has introduced drop-forged "Weldolets" and

"Thredolets." These units are individual fittings, designed to be installed by simply welding them to a pipe line, using a fusion or V-weld, then removing the button and completing the junction by welding or screwing the branch pipe to the Weldolet or Thredolet. Turbulence and friction are greatly reduced by the funnel-shaped outlet, which allows an unrestricted flow from the main pipe.



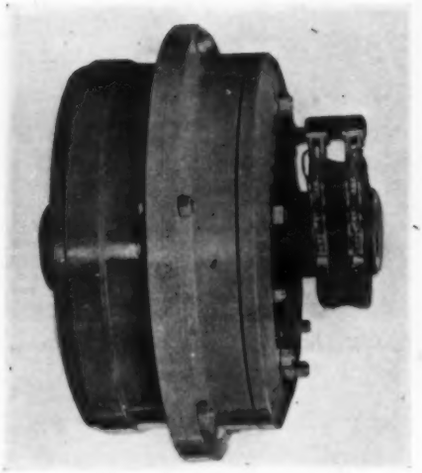
Weldolet and Thredolet applied to pipe

Units are designed with a heavy external rib which provides great strength and in addition dissipates the excess heat when welding, thus preventing shrinkage and distortion. Two welds are required to install the Weldolets, one at the line of contact with the main pipe, the second where the branch and outlet of the Weldolet join. They may be used wherever it is necessary to make T's side-outlet T's crosses, double-crosses, etc., by welding. Thredolets require only one weld, the outlets being tapped. It is only necessary to thread and screw the branch in position. They are suitable for low-pressure heating systems, for branch lines and radiator fittings. They may also be used to make any number of combinations of T's, double-crosses, side-outlet T's, etc. Weldolets are available to fit pipes from 1 to 12 in. Thredolets are available to fit pipes from 2 to 12 in. in diameter.

"Stearns" Improved Multiple-Disk Magnetic Clutch

The Magnetic Mfg. Co., Milwaukee, Wis., has announced a multiple-disk magnetic clutch claimed to be extremely simple in construction, operation and adjustment. The clutch does not drive through spring plate or pins, the armature and field do not move relative to each other, and the entire clutch has no toggles, cams, rollers, or yokes to cause trouble. Only one wearing surface, the friction lining, is incorporated, and this lining may be taken up for wear by a single adjustment.

Other advantages of the new clutch are: Reduced size, less space for installation; small diameter clutches take care of heavy loads; greater



friction area; multiple disks provide ample friction area at low pressures, and reasonable cost. The accompanying illustration shows the assembled clutch with positive control elements.

"Oliver" No. 185-D Motor-Driven Belt Sander

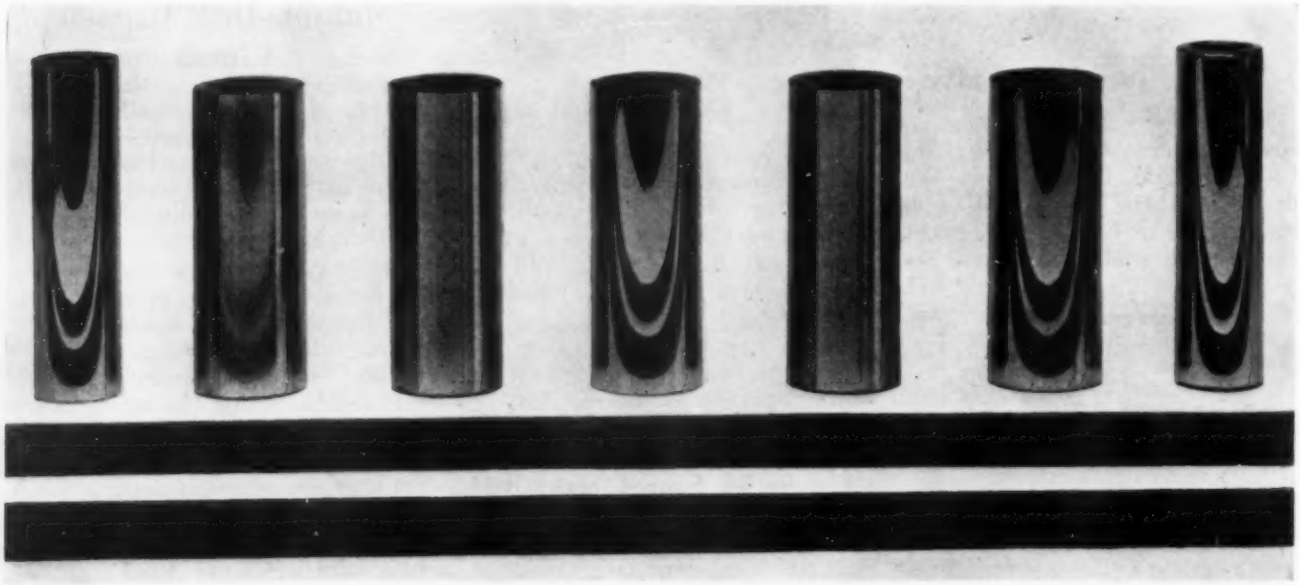
In modern sanding requirements, wherein a thin fabric back belt is used folded to suit the shape of the piece being sanded and is applied to the piece by means of a hand grip form which is a counterpart of the shape being sanded, it is desirable to have the sand part of the sanding belt next to the pulleys to prevent slippage of the belt across the pulley faces. To fill this requirement, the No. 185-D direct-motor-driven under-belt sander is being manufactured by the Oliver Machinery Co., Grand Rapids, Mich. The machine is developed not only for use with wood, but for sheet steel, aluminum, bronze, brass and composition. It will sand flat or slightly curved surfaces.

In general, the machine is made up of three separate units, a table, the motor stand and the idler stand. The universal adjustable idler pulley and the many ways of adjustment of the table make the machine quite flexible. The table is exceptionally large, wheels are aluminum with live rubber facings. The sanding belt is reversible. Ball bearings are used throughout. The belt length can be made as long as the user wishes it, that is the columns can be placed any distance apart. This permits the sander to operate considerably longer without wearing out the belt.

The table of the unit is 32 in. wide by 96 in. long, rolled from front to back on ball bearing and adjustable vertically 14 in. A 2-hp., 900-r.p.m., direct-connected motor is furnished.

Carborundum Grinding Wheels for Unusually High Finishes

The Carborundum Co., Niagara Falls, N. Y., announces the production of solid grinding wheels capable of producing the high finishes ordinarily obtained by burnishing or by lapping with compound or any loose-grain abrasive. The development of these wheels first necessitated the production of uniform grains or grits in the finest sizes. Both Aloxite Brand aluminum oxide and Carborundum Brand silicon-carbide are used, depending upon the character of the material to be ground or finished. The finest of impalpable powders are produced in the Carborundum laboratories for these wheels. These powders are so fine that they literally flow, and yet they have the power to cut clean and fast.



The problem of bonding such extremely fine powders into a solid wheel also called for the development of a special bond.

The new grinding wheels are not intended for production grinding in the sense of removing large amounts of metal. Their job is to produce the final luster or finish after a series of progressively finer wheels has been used for removing diminishing amounts of stock in order to prepare the surface for the final finish. The amount of metal to be removed by the finishing wheels depends upon the scratches or wheel marks left by the previous wheels. The finer the surface given by the preliminary wheels, the quicker the ultimate finish is obtained and the less wear on the final wheel.

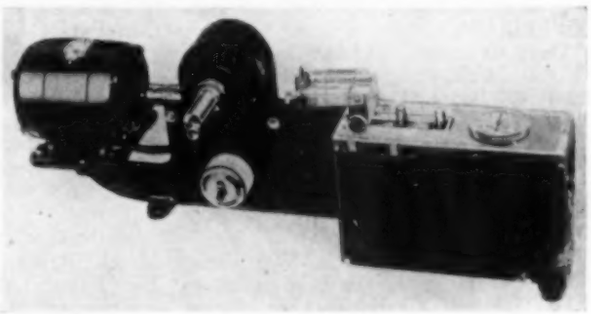
Varied fields are open for the new wheels. They can be used for finishing piston-pins, bearings, bearing raceways, and various types of rolls used in the metal and textile trades.

An unretouched photograph showing steel pins with various types of finish is reproduced in the accompanying illustration. In order to compare the finishes, the photograph was taken with two strips of blueprint paper lying in front of the pins so as to be reflected by the surfaces. The pins at the extreme right- and left-hand ends, as well as the one in the middle, were ground with the new type of finishing wheel. The sixth pin from the left has the highest finish said to be heretofore obtainable with grinding wheels, while the second, third, and fifth pins from the left have Nos. 1, 2 and 3 finishes.

It will be noted that on two of the pins there is no reflection whatever of the blueprint strips and that the second pin from the left shows just a faint reflection. The two pins on the ends and the one in the center, all ground with the new finishing wheel, give almost perfect reflections.

"Triplex" Dynamometer

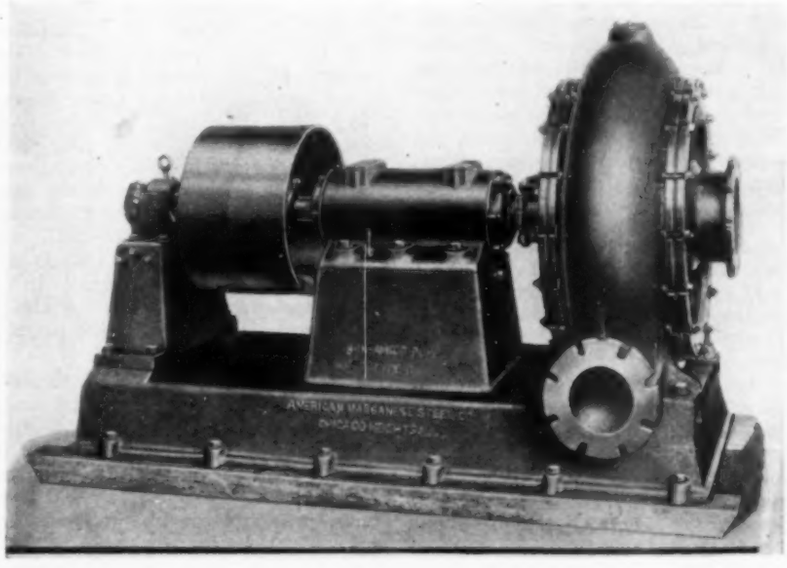
A "Triplex" dynamometer for testing diamond wire drawing dies is being manufactured by Robert Miller, 221 No. 23rd St., Philadelphia, Pa. The unit indicates accurately the traction required to draw a wire through the die. It may be set so that the indicator hand remains at the maximum reading, allowing ultimate break tests.



The unit contains three scales, the finest of which reads in hundredths of pounds. The middle scale reads from 0 to 10 lb. and the largest from 0 to 100 lb. The length of the unit is 25 in., its height is 8½ in,. and its weight 38 lb.

AMSCO Type "C" Abrasive Materials Handling Pumps

The American Manganese Steel Co., Chicago Heights, Ill., has recently added Type "C" to its line of abrasive materials handling pumps. This new pump is of strictly AMSCO design, made of the company's manganese steel, and incorporates a number of features. Bearings are interchangeable in the field, either sleeve or anti-friction types being available. Lubrication is required only on main bearings (except where outboard bearings are used), impeller clearance and main bearings can be adjusted easily without dismantling, thrust and radial shocks are absorbed by a changed bearing arrangement. The pump is claimed to combine long life, high capacity and reasonable price.



PATENTS

AUGUST 11, 1931

Metal-Working Machinery

Grinding Machine. Clarence C. Stevens, Bristol, Conn., assigned to The New Departure Manufacturing Co. Patent 1,817,953.

Lathe. John M. Christman, Detroit, Mich., assigned to Packard Motor Car Co. Patent 1,818,042.

Milling Machine Transmission. Fred A. Parsons, Milwaukee, Wis., assigned to Kearney & Trecker Corporation. Patent 1,818,089.

Hydraulic Honing and Lapping Machine. Thomas F. Quigley, Cleveland, Ohio, assigned to Micromatic Hone Corporation. Patent 1,818,098.

Manufacture of Wire Chain. Richard Wirth, Frankfort-on-the-Main and Wilhelm Bittrolf, Pforzheim, Germany, assigned to Ernst Gideon Bek, Pforzheim, Germany. Patent 1,818,111.

Automatic Lathe. William F. Groene, Cincinnati, Ohio, assigned to The R. K. Le Blond Machine Tool Co. Patent 1,818,128.

Machine for Expanding Metal. William W. Galbreath, Warren, Ohio. Patent 1,818,246.

Grinding Machine. Ernest A. Walker, Worcester, Mass., assigned to John Bath. Patent 1,818,288.

Bit-Forging Machine. Louie Bortkewicz Racoon, Pa. Patent 1,818,601.

Method of and Machine for Strand-

ing Special or Figured Wires. Ferdinand Fessl, Vienna, Austria, assigned to Felten & Guilleaume Fabrikelektrischer Kabel-Stahl-und Kupferwerke Aktiengesellschaft, Vienna, Austria. Patent 1,818,845.

Automatic Arc Welding Machine. Leon D. McIlvin, Lynn, Mass., assigned to General Electric Co. Patent 1,818,859.

Processes

Method of Grinding. Adolph L. Nelson, Detroit, Mich., assigned to Bohn Aluminum & Brass Corporation. Patent 1,818,084.

Oval Grinding. Adolph L. Nelson, Detroit, Mich., assigned to Bohn Aluminum & Brass Corporation. Patent 1,818,085.

Art of Cutting Circular and Other Non-Rectangular Blanks from Sheet Metal. John H. Murch, East Orange, N. J., assigned to American Can Co. Patent 1,818,150.

Electroplating. Leon R. Westbrook, Cleveland Heights, Ohio, assigned to The Grasselli Chemical Co. Patent 1,818,179.

Method of Forming a Compromise Rail Joint Bar. Daniel Lawrence Braine, Brooklyn, N. Y., assigned to The Rail Joint Co. Patent 1,818,880.

Tools and Attachments

Chuck for Machine Toools. Edward Sears and Carl F. Watner, Deer Lodge, Mont. Patent 1,818,167.

Collet Chuck. George M. Class, Madison, Wis., assigned to Gisholt Machine Co. Patent 1,818,305.

Cylinder Lapping Tool. John G. McFadden, Camp Holabird, Md. Patent 1,818,491.

Gear. Ernest C. Head, Rochester, N. Y., assigned to Gleason Works, Rochester, N. Y. Patent 1,818,554.

Reamer. Albert C. Hoeh, Royal Oak, Mich. Patent 1,818,621.

Driver for Reamers and the Like. Albert C. Hoeh, Royal Oak, Mich. Patent 1,818,622.

Welding Apparatus. Joseph A. Baker, Roseville, Mich., assigned to Chrysler Corporation. Patent 1,818,665.

Micrometer Calipers. Camille Joriot, Lac - Ou - Villers, France. Patent 1,818,853.

Mixer for Welding Torches. George L. Hammon, San Francisco, Calif., assigned to National Welding Equipment Co., Limited. Patent 1,818,949.

Subplate for Drill Jigs. Joseph F. Stumpf, Chicago, Ill. Patent 1,818,966.

Furnaces

Apparatus for Treating Solid Materials. William A. Garrah, Chicago, Ill. Patent 1,818,308.

Furnace. Jewett F. Schrumn, Attleboro, Mass., assigned to Process Engineering and Equipment Corporation. Patent 1,818,759.

Electric Furnace. Henry Gordon Campbell, Dundee, Scotland. Patent 1,818,789.

AUGUST 4, 1931

Processes

Metal Pickling Process. George L. Magoun and Deal H. Tompkins, Nitro, W. Va., assigned to The Rubber Service Laboratories Co. Patent 1,816,860.

Welding Method and Apparatus. Thomas E. Murray, Jr., Brooklyn, N. Y., assigned to Metropolitan Engineering Co. Patent 1,816,864.

Process of Cleaning Wire. Carl John Warnke, Elkhart, Ind., assigned to Minneapolis-Honeywell Regulator Co. Patent 1,816,881.

Glass Furnace Forehearth. Alexander Francis McNish, Perth, Scotland, assigned one half to John Moncrieff Limited, Perth, Scotland. Patent 1,816,982.

Electric Welding Process. Oscar L. Mills, Los Angeles, Calif. Patent 1,817,092.

Method of Open Annealing Sheet Metal. Arthur T. Kathner, Pittsburgh, Pa. Patent 1,817,152.

Treating Metals and Compositions Therefor. James C. Vignos, Nitro, W. Va., assigned to The Rubber Service Laboratories Co. Patent 1,817,500.

Metal Treating Apparatus. Conrad Schumacher, Lynbrook, N. Y., assigned to Autostrop Patents Corporation. Patent 1,817,902.

TRADE PUBLICATIONS

BALL BEARING MOUNTINGS. The Fafnir Bearing Co., New Britain, Conn., has issued a 12-page booklet under the title of "Typical Mountings for Ball Bearings," giving suggestions for the design of such mountings with a number of illustrative diagrams.

CUTTING & GRINDING. The Sun Oil Co., Philadelphia, Pa., has issued a new booklet on Sunoco emulsifying cutting oil, entitled "Cutting and Grinding Facts." This is a second edition, containing a newer, larger and more comprehensive assortment of operations and an analysis of the firms utilizing the company's cutting oils in cutting. Illustrations and data on the operations and mixtures used are included.

DIE SETS. The Danly Machine Specialties, Inc., 2104 So. 52nd Ave., Chicago, Ill., is issuing a monthly magazine under the title of "The Danly Guide Post," containing articles for designers, draftsmen and die builders. The first issue includes one article explaining how five punch holders were used with one die-holder. Another deals with the use of die sets as assembly fixtures, and still another with the use of transparent templets for determining the correct die set for the die. It is available without charge to those requesting it.

FLOOR CONSTRUCTION. The Carnegie Steel Co., Pittsburgh, Pa., has issued a bulletin on "T-Tri-Lok Bridge Floor Construction."

IMMERSION HEATERS. H. O. Swoboda, Inc., 3400 Forbes St., Oakland Station, Pittsburgh, Pa., has issued Bulletin No. 230 illustrating the company's bare electric immersion heaters for viscous materials.

INDUSTRIAL X-RAY. Robert W. Hunt Co., 2200 Insurance Exchange, Chicago, Ill., has issued a four-page folder announcing an additional laboratory service for the determination of quality in engineering materials.

INSPECTED APPLIANCES. The Underwriters' Laboratories, 207 E. Ohio St., Chicago, Ill., has issued a List of Inspected Gas, Oil, and Miscellaneous Appliances, and a List of Inspected Fire Protection Appliances under date of July, 1931. The first contains 140 6x9 in. pages and the second, 132 6x9 in. pages.

RAILROAD DATA. The Committee on Public Relations of the Eastern Railroads, 143 Liberty St., New York City, has issued "A Yearbook of Railroad Information," supplying a ready reference for authoritative facts relating to the railroad industry.

RANDOM SAMPLING. The Bell Telephone System has issued Monograph B-576, dated July, 1931, on "Random Sampling," by W. A. Shewhart of the Bell Telephone Laboratories. The booklet is a reprint of a paper presented before the Mathematical Association of America at a recent meeting.

SAFETY PANELBOARD. The Switch & Panel Division, Square D Co., Detroit, Mich., has issued a supplementary section to Bulletin CA-505, which describes its standard convertible safety panelboard. The supplementary section, Bulletin CA-505-A, describes the new shallow type convertible safety panelboard with capacities up to and including 100 amp., 250 volts.

SHEET STEEL PRODUCTS. The Inland Steel Co., First National Bank Bldg., Chicago, Ill., has issued a new edition of the booklet "Inland Open Hearth Sheet Steel Products," containing all information, brought up to date, ordinarily needed for ordering steel sheets. Standard extra and differentials, sheet weights, and bundling tables, standard commercial tolerances, and trade customs and practices are included as well as concise descriptions of all Inland sheet steel products. The booklet is coat-pocket size, containing 56 pages of condensed data.

STAINLESS STEELS. The Republic Steel Corp., Massillon, Ohio, has issued a folder on Enduro-FC free-cutting stainless steel, containing authentic information on the alloy, including such information as analyses, physical properties, properties at high temperatures and instructions for working.

WIRE AND SHEET METAL GAGES

WIRE and sheet metal gages, prime necessities before the invention of the micrometer, were originally evolved by individual manufacturers in order that certain sizes could be reproduced upon customer demand. Their unconformity was an advantage, for it bound the user to his original source of supply. These gages were later supplemented by others prepared by associations or established by government authority, the net result being to increase the number of systems, until there are now at least 30 systems, with about 1,225 sizes, in active use in the United States.

Even though some systems are almost obsolete, it is impossible to be familiar with all phases of their application, particularly because of the inconsistencies and duplications in use. Many systems are rule-of-thumb, consequently the divisions are irregular and unsystematic; again, the gage number does not tell the size unless the decimal equivalent has been memorized or a laborious amount of reference to tables is undertaken. Measures to alleviate these unsatisfactory conditions are underway, but meantime trade customs die hard and the old confusion persists. Until final standardization, confusion and mistakes may be held to a minimum by observing these rules:

1. Always give name of the gage in addition to the number on drawings, specifications and orders.

2. Be sure that the correct gage system is used for the material in question.

3. Use decimal equivalents, preferably in conjunction with the gage name and number.

As an aid to carrying out these rules, the accompanying tabulation is given. It lists the more important gages and gives their scope of application, together with a description of their characteristics. Tables of decimal equivalents are not given as they are readily available in handbooks and catalogs.

United States Standard Gage (U.S.S.G.)

Use: Uncoated steel sheets and plates; also long terne plates and light tin plates (occasional).

Range: 7/0 to 38. Extended by custom to 44. Heaviest commercial size is 3.

General: Established by the United States Government and based on the weight per square foot with the equivalent thickness calculated on the basis of 0.2833 lb. per cu.in.

Galvanized Sheet Gage (G.S.C.)

Use: Galvanized Sheet Steel.

Range: 8 to 34.

General: Identical with U.S.S.G. except for addition of 2½ oz. per sq.ft. to cover weight of galvanizing.

Tin Plate Gage (T.P.G.)

Use: Tin plate and small terne plate.

Range: 55 to 435 lb.

General: Differs from ordinary gages as the thickness is not measured by gage number but by the weight of a "base box." This consists of 112—14x20-in. sheets or any other combination having the same area of 31,360 sq.in. The weight of the box varies with the thickness of the sheets from 55 lb. for sheets with a thickness of No. 38 U.S.S.G. to 435 lb. for sheets of approximately No. 18 U.S.S.G. Symbols such as IC, IX, DX, etc., have been adopted by the trade for certain widely used weights.

Sheet Zinc Gage

Use: Zinc Sheets.

Range: 1 to 28.

General: The gage numbers increase with greater thickness of the sheets.

Steel Wire Gage (Stl. W. G.)

Use: Steel wire, except steel telephone and telegraph wire, music wire and tool steel wire. Also frequently used for non-ferrous wire for weaving into cloth.

Range: 7/0 to 50.

General: Practically identical with American Steel & Wire Co., Roebling and Washburn and Moen Wire Gages and supersedes them.

Music Wire Gage (M.W.G.)

Use: Music or piano wire.

Range: 6/0 to 45.

General: The gage numbers increase with the size of the wire. There are several different music wire gages in general use, two of which are the American Steel & Wire Co. and the American Screw & Wire Co. gages.

Brown & Sharpe Gage (B. & S. G.), American Wire Gage (A.W.G.)

Use: Non-ferrous wire, brazed non-ferrous tubing and all non-ferrous sheets except soft and hard copper sheets; ribbon and clock spring steel.

Range: 6/0 to 50.

General: Each size is approximately 89% of the next larger.

Stubs Iron Wire Gage, Warrington Wire Gage (W.W.G.), Birmingham Wire Gage (B.W.G.)

Use: All steel tubing and seamless non-ferrous tubing, steel plates, bands, hoops, sheet spring steel, cold rolled steel strips, steel or iron telephone and telegraph wire, soft and hard copper sheets.

Range: 5/0 to 36.

General: In ordering soft or hard copper sheets, use the name "Stubs" in preference to B.W.G. or W.W.G.

Stubs Steel Wire Gage

Use: Drill rod and tool steel wire.

Range: 1 to 80.

Twist Drill Gage (T.D.G.)

Use: Small sizes of twist drills.

Range: 1 to 80.

General: Slightly larger than same numbers of Stubs Steel Wire Gage. It is also known as "Manufacturers' Standard."

Old English or London Gage

Use: Non-ferrous wire for weaving into cloth (occasional).

Range: 4/0 to 40.

American Screw Gage

Use: Wood and machine screws.

Range: 3/0 to 50.

British Imperial Standard Wire Gage

Abbreviations: Great Britain: W.G., B.W.G. United States, I.S.W.G.

Use: All wire in Great Britain. Occasionally used in U. S. for copper telephone wire.

Range: 7/0 to 50.

British Standard Gage for Iron and Steel Sheets and Hoops (B.G.)

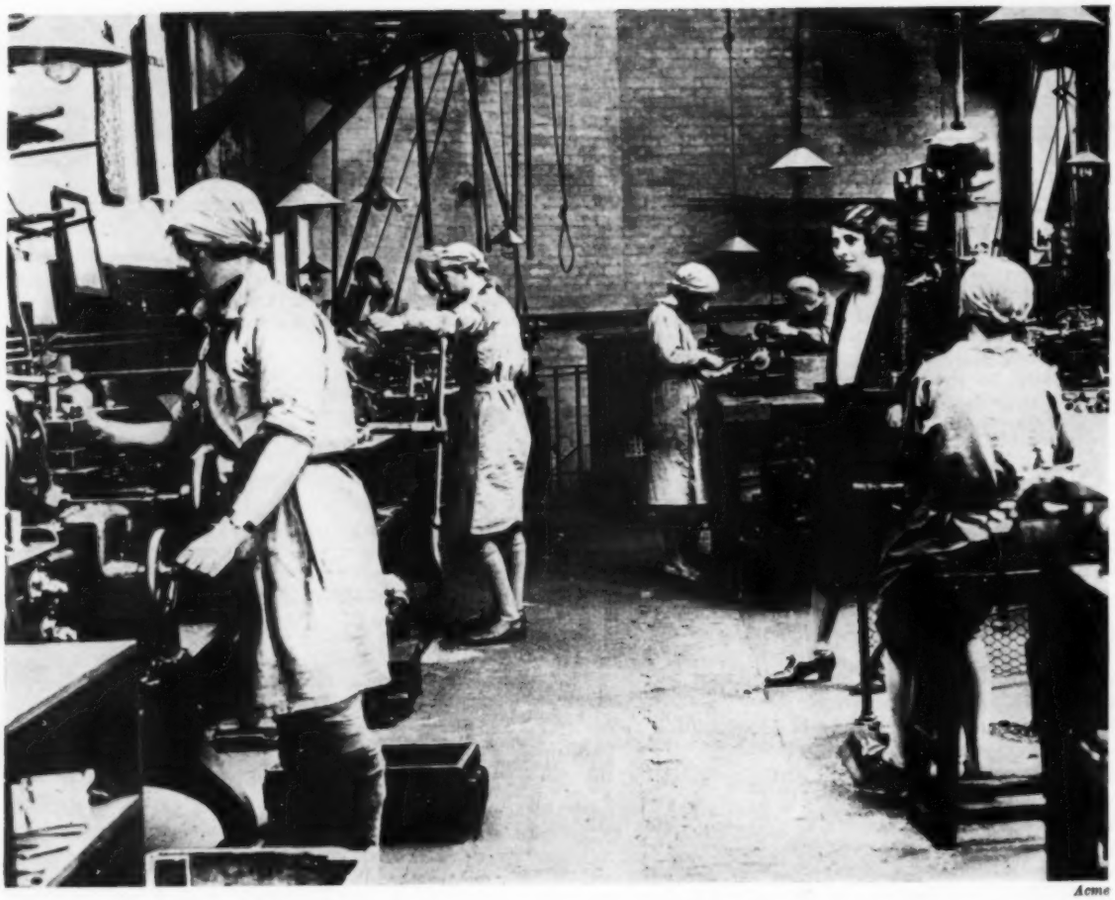
Use: Iron and steel sheets and hoops in Great Britain.

Range: 7/0 to 50.

General: Also known as New Birmingham Gage.

Contributed by Charles P. Miller

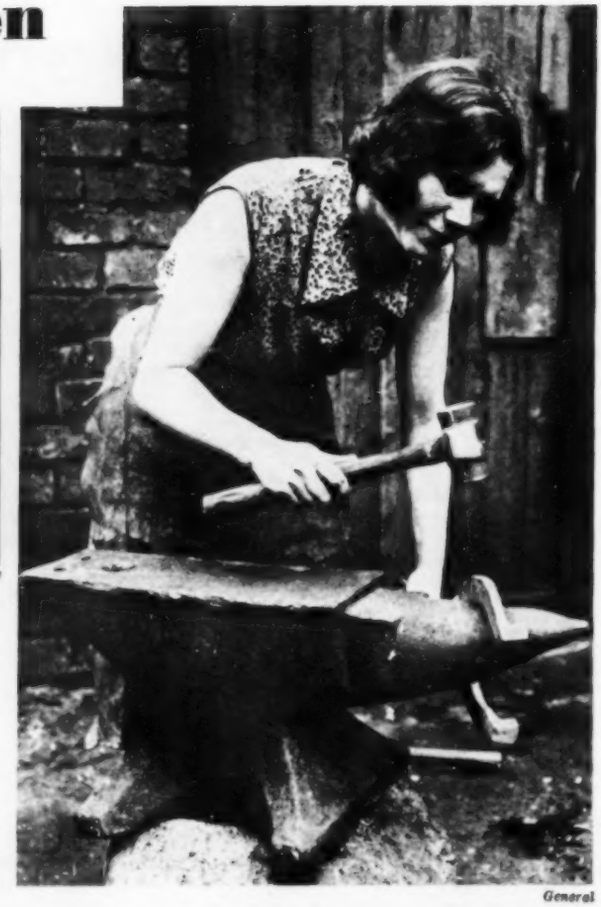
© American Machinist



Acme

British Craftswomen

Acme



General

WOMEN have entered almost every profession, causing endless discussion regarding their comparative skill, dependability, wage, and the economic problems involved. Many small parts manufacturing operations are now entrusted to women, but London, England, claims the world's only all-woman machine shop, "Atalanta, Ltd.," so outstanding that it has been given British government and British Broadcasting Company contracts. Again Margaret Norton, 27, last of the British Black-country women blacksmiths, works six hours a day in her smithy at Heathtown, Staffs.

AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, August 20, 1931

VOL. 75 NO. 8

Paradoxes

The government buys wheat. The wheat surplus rises, and the price falls.

The government buys cotton. The cotton surplus rises to eleven million bales, and the price falls. The Farm Board urges plowing under every third row now growing.

European governments buy surplus labor. Unemployment increases, and wages fall. Only war can plow under the third row. Can we learn from the experience of others?

Safe Aisles

In laying out a new plant or a new department, one inevitably confronts the question of how wide to make the aisles between machines. That there is no fixed standard is evident from a casual survey of shops about the country. Recently, moreover, the Metals Section of the National Safety Council proved this concretely by an informal survey among its members. One advocated aisles of three and a half feet with small machines and four and a half feet with larger; another, five and a half feet as an "absolute minimum;" still another advocated eight feet as a minimum; others between.

Actually, there is no one best aisle width. Too much depends upon material handling facilities, whether by hand, electric or other mechanical truck, and the bulk of the material handled. In one modern railroad shop, for example, where large heavy pieces must be moved, there is a main aisle twelve feet across, wide enough to drive a ten-ton truck right through the shop. The presence or absence of an overhead crane is another deciding factor, for like commercial airways, there must be a marked ground route below, free from congested areas.

As for a footpath through the wilderness, the trail must be cut wide enough to clear the packer's burden. As one packer puts it: "If a man walks down the aisle with a neck yoke full of bird cages, he will need to have lots of room." The example is exaggerated, but to the point. If the workman must pile material on the floor about him, space must be allowed for it also, plus the material belonging to the man across the aisle.

Paramount to all considerations is safety, not only to guard against possible injuries from fast moving electric trucks, but to eliminate fire hazards as well. In an emergency, a narrow, blocked aisle may result in a stampede. An intelligent solution to any particular aisle problem can be arrived at only by coordinating all factors, but never by allowing safety to become subordinate to superficial economic considerations. One serious accident may offset any theoretical savings on floor-space overhead.

The Red Smokestack

Years ago we knew a railway master mechanic who had a keen appreciation of human psychology even though he had never even heard the word mentioned. Inventors were pretty numerous in those days, and all sorts of ideas were proposed. One was for a new exhaust nozzle that would make any engine steam better, and the master mechanic agreed to try it. The front end was not to be opened for two weeks, and the smoke stack was painted a brilliant red to designate the engine.

Both engineer and fireman were enthusiastic over the new device—until they opened the front end at the end of two weeks. It was the same old exhaust nozzle. The new one was on another engine, and the crew never knew the difference. Imagination, aided by the red smokestack, made the performance seem better.

The same thing happens every day in the shop with new cutting tools, cooling compounds and

the like, if results are left to the opinions of the shop men. It is very easy for any of us to fool ourselves unless we have some definite way of measuring results. Labels, red smokestacks and imagination still play too big a part in industry. We need yardsticks to measure results.

Pay Only for Machine Time

One of the credit items which may tend in some measure to balance certain present debit items is the increased attention being given to improved operating conditions. One company is finding it economically advisable to utilize its principles of motion economy, as developed by the standards department, in the layout of machine equipment.

When a department is due to be rearranged, the motion study man is first called upon to determine the feasibility of having one operator run several machines. The machines are then so located that the operator has a minimum of lost time. Automatic returns are provided.

One operator was observed running machines doing ten operations. This might be called a violation of the straight line flow principle. But it kept the operator busy.

◂◂ CHIPS ▸▸

Ascribe it to dogdays or blue funk or Alexander Legge as you will . . . the Farm Board made the front pages with its cotton proposal . . . also provided more material for radical agitators than they have had for many a blue moon . . . Governors of the cotton states are to be commended for their prompt rejection.

Construction started on second Grace liner at Federal Shipbuilding Co. . . . means two years of steady employment for over two thousand men . . . Hawks again lives up to his name by flying Chicago to New York in three hours and three quarters . . . president of Duquesne University claims to have trisected the angle by plane geometry . . . engineers await proof.

Signs of recovery are not as plentiful as one would like . . . but they are far from lacking . . . Baldwin Locomotive reports gains for three months . . . July bookings 1,946,000 dollars against 1,909,000 last year; June 4,400,000 against 2,095,000 . . . Allis-Chalmers receives new orders totaling 1,006,000 as result of American Brown Boveri acquisition . . . 350,000 from Long Island R.R. alone . . . Aluminum Industries, Inc., of Cincinnati, reports capacity operations.

Good demand for coal mine equipment, particularly in Indiana . . . the Hoosier State has a new law requiring all governmental units to use Indiana mined coal . . . more Hoosier mines going into production . . . General Motors July sales of motor vehicles increase nine per cent over 1930 . . . Dodge cars up even more . . . Out-of-town buyers in New York at this time are ten per cent more numerous than last year . . . Sales of electric washing machines, 341,000 units in first six months, 319,000 same period 1930.

RE APPRENTICE TRAINING

"A. W. Forbes, writing in 'Chips' (*AM*—Vol. 75, page 224b) in reply to the editorial, 'Training Programs' (*AM*—Vol. 74, page 814), calls attention to the attitude of boys and their parents in turning away from apprenticeships in dull times when the need of vocational training is even more apparent. An insight into the minds of these boys and their parents as well as a general idea of their home conditions would, I believe, firmly convince Mr. Forbes that their attitude is not the result of ignorance nor of lack of interest in apprenticeship training. Rather it is due to their inability to meet the costs.

"Apprenticeship material is invariably drawn from the homes of men who lack, themselves, the necessary education and training to qualify for highly paid positions and who wish to start their sons right. Those more fortunately situated send their sons to trade schools and technical colleges.

"It is well known that apprentice courses pay only nominal wages; the training is considered the chief remuneration for the work accomplished. Out of these nominal wages must come the price of books and tools. Also, there is the enrollment fee, returnable when the course is completed of course, but a burden at the time nevertheless.

"When times are bright and wages high, the fathers of these boys can afford to start them in apprentice courses by paying the enrollment fee. They are then satisfied if the boys receive enough to pay their way and possibly to clothe themselves. For this reason, during brisk times when labor is scarce, there always is a group of boys available for apprenticeship training.

"When times are dull and wages of labor drop and idle periods follow short time, it is extremely difficult for the father of one of these boys to meet the costs of the actual necessities of life let alone pay enrollment fees or carry along the living costs of the boy in training. For this reason it becomes necessary for the boy to go out into direct labor where he can earn more to help keep the family together and in reasonable comfort. Thus it is that the parents must gamble with the boy's future to provide for the present.

"Having come up thru the apprenticeship route myself, I realize the problems these boys and their parents must face, better perhaps than those who have always been on the sunnier side of life where they need only consider what would be of the best advantage in the future."

—J. A. Lawson.

AMERICAN MACHINIST AWARDS

Two more entries during the past week . . . more than half a dozen requests for terms and conditions . . . one fine brief already on file . . . Don't forget the closing date, September 1, 1930.

Europe seems a little bit too calm . . . signs develop that England really is beginning to like her dole . . . Hoover moratorium put into effect, subject to ratification by twenty-four governments and our own far-sighted Senate . . . Germany seems satisfied that she can extract no more credit and is getting down to business . . . Tariff makers, raisers and adjusters, please note: forty-five countries have boosted duties on American goods during the past year . . . Branch American plants spring up like toadstools in foreign lands . . . they may be equally poisonous to our foreign trade.

SAVING ON L.C.L.

Comes forward Elihu Church with a plan for reducing the cost of L.C.L. shipments. As approved by the Interstate Commerce Commission, the railroads will be enabled to provide re-usable containers mounted on rollers. The shipper will pay only the freight on the goods shipped plus a small service charge for the container, a fraction of the normal boxing or crating costs. We shall be glad to hear from interested shippers.

BETTER AND CHEAPER

A man was discovered by his wife one night standing over his baby in its new crib. She silently watched him. As he stood looking down at the sleeping infant, she saw in his face a mixture of emotions—doubt, despair, incredulity. Touched and wondering alike at this unusual parental attitude and the conflicting emotions, the wife with eyes glistening arose and slipped her arms around him.

"A penny for your thoughts," she said, in a voice tremulous with tenderness.

Startled into consciousness, he blurted them out: "For the life of me, I can't see why anybody should make a crib like that when it could be made so much better and cheaper by spot welding!" —*The Danly Guide Post.*

THIS WEEK IN *AM*

Like the mother who neglects herself for her children, or the shoemaker whose progeny run barefoot, some machine tool builders allow their own equipment to run down while taking care of their customers. But Ingersoll Milling Machine Company, among others, finds it entirely possible and profitable to keep its own plant on a high plane, thus enabling it to take even better care of its customers.

In the lead article of the week, K. H. Condit, editor of *American Machinist*, describes Ingersoll replacement policy and practice in an interview with Robert M. Gaylord, president (page 293).

Ken G. Niblack continues his exposition, "Optics in Metal Working," with a discussion of the contour projector and the low-power microscope (page 307). We begin a series of well illustrated articles showing various phases of Marmon Sixteen production. This installment covers the cylinder block line (page 301).

"Gear Cutter Comparator," by Sam Trimbath, discloses a device that has been found most effective in his shop (page 296). "Working Nitro-Cellulose and Other Plastics," provides modern methods for molding and machining these materials (page 313). If you are confused about the multitude of wire and sheet metal gages, turn to the reference book sheet on page 327. On the other side of that sheet, you will find pictures of the first machine shop "manned" and managed by women. Railroad men and others will be interested to see how Norfolk & Western assembles its hopper cars (page 310).

• COMING •

With higher and higher speeds the rule—we have seen an air-tool spindle revolving at two hundred thousand r.p.m. — balance becomes an inevitable consideration. Before we are through with it we expect to dig deeply into the whole subject. As a starter, next week, we shall feature an inquiry into static balance, by Chester B. Lord, associate editor of *American Machinist*.

In the same issue will appear the experiences of an English machine and tool designer in the production of hot rolled nickel steel pinions.

Nikola Trobojevich, research engineer, The Timken-Detroit Axle Co., will contribute "Some Advanced Worm Hob Designs." This article will contain material of value for almost any plant in the industry.

Looking even further into the future to September 17, we wish to announce an issue which will contain special material on heat-treating and welding, plus abstracts from the principal papers to be read at the National Metals Congress, Boston. As an additional feature we expect to include a veritable symposium of solutions to various problems met in the machining and forming of stainless steel.

THE . INDUSTRY .

Progress in Metal-Working and Machinery Markets

LABOR DAY is considered New Year's in machinery and machine tool markets. Those who expected little or no business during August are not disappointed thus far. Dealers and builders are optimistic over prospects, and business in general seems to have the feel that things will soon be starting again. Meanwhile, N.M.T.B.A. indexes show a continuing of June's decline. Gross orders dropped from 73.6 in June to 61.5 in July, while the three-month average dropped from 88.6 to 74.1. Class B plants ($10,000-$50,000 shipments average in 1922-24) had an index increase from 70.3 to 95.4, others declined about 20 points. The index of shipments dropped from 94.6 to 72.2, while the index of unfilled orders dropped from 212.2 to 202.3. In several cases, July was the best month of the year except March, possibly foreshadowing improvement shortly. Electrical energy consumption reports show a still further decline in activity.

NEW YORK awaits action on the 17-tool Navy Yard inquiry and cusses the Board of Transportation for the unsatisfactory 52-tool subway list, upon which most dealers refuse to bid. Chicago has completed its school buying and nothing new has turned up. The fall is expected to bring an upturn and midwest plants are preparing for increased fall business. Indianapolis has sold some equipment to Chrysler and Plymouth, but expects no real improvement until winter. Canada inclines to Chicago's opinion, expecting the upturn sooner, basing the prediction upon industrial prospects.

DETROIT, except for two dealers, reports a downtrend in sales curves, though contract shops are stepping up activity. New England holds even at the July level, with Van Norman working on a 65-grinder Soviet order. Los Angeles and Cincinnati sing a depression duet.

NEW YORK

Little, if anything, of interest developed last week. No action has been taken on the Brooklyn Navy Yard list. Few other lists are in sight, and the Board of Transportation list has earned considerable criticism because of its form. Containing about 44 machine tools and 8 woodworking tools, it looked at first glance like a good thing, but the contract is so worded that the supplier may have payment withheld indefinitely if he fails in supplying as much as one capscrew. Again, he must install the units and even supply tools for them, must make a lump bid and do several other things that have ended up by causing many dealers to refuse to bid.

CHICAGO

While business rests at one of the lowest levels it has dropped to in some years, and present inquiries are mostly limited to replacement necessities, there continues to be an undertone of optimism, an upward trend being looked forward to in the fall. With the closing on most of the equipment needed by the Chicago Board of Education, there appears to be nothing in sight in the way of important new inquiry. Dealers in used tools complain that sales are few.

INDIANAPOLIS

Business continues very spotty. Where a little improvement is noted in some lines, business in others will drop off. The last two weeks has seen some business from the automobile trade. Among the most likely purchasers just now are the Chrysler plants. One large foundry here is getting most of its business now in Plymouth parts.

That there will be little betterment in business before winter is the general opinion. All seasonal demand is dropping to rock bottom, particularly contractors' equipment, which except for road equipment, did not sell well during the entire year. Demand for small tools from the radio factories seems to be improving somewhat. Refrigerator factories are through buying for the year, from all indications.

CANADA

With industrial production generally at the lowest ebb of the current year there is little demand for either new or used tools. The only bright spot is that inquiries indicate considerable buying in the fall. There will be an improved market for railway equipment; heavy construction proposals in the engineering group of the building industry augur well for the structural steel and allied industries, while an anticipated upturn in automotive production will be a welcome boon to manufacturers of parts and accessories. At present automotive production is away below normal. Norwithstanding a curtailment of flying in Canada, there has been no retrenchment in aircraft manufacturing.

DETROIT

The machinery and machine tool trade continues to drift aimlessly. Most dealers report sales for August below any month of the current year. Two dealers report a slow but steady increase in volume since July and August of 1930. They believe this is an indication of a gradual return of better business.

Small contract jobbing shops are increasing their activity. Many have added 50 percent to their personnel and are buying a little equipment. These shops are doing work for the automobile plants. Their activities constitute a fairly good prediction of the immediate future of the auto industry. If the small shops are as busy as they expect to be during the next six weeks, the machinery and tool business will experience a pleasant advance in prosperity.

NEW ENGLAND

Thus far in August, machine tool sales have been at about the July level. Orders of any considerable size are scarce, and despite a number of closings just around the corner, little hope is expressed for a period of brisk buying in the present month. A reviving interest in small tools is, however, worthy of consideration.

Substantial foreign inquiries are an encouraging feature from four different countries. Van Norman, Springfield, has completed the first few machines of a $200,000 order for 65 oscillating grinders for four Soviet plants.

LOS ANGELES

It would be considered a privilege to report some definite upward change in the machinery and shop supply business. The fact of the matter is however, that little or no change has occurred for a considerable time. Concerns who are good buyers in usual times have naturally curtailed purchases to the limit; this being particularly true in the oil and picture industries as well as in various other lines. Reduction have also occurred in equipment purchases for school purposes.

CINCINNATI

General market lassitude still prevails and business merely is dribbling in to manufacturers from various classes of users fortunate enough to secure orders which require additional equipment. Following the canicular days it is thought things will take a turn for the better. Selling agents are having some success in developing prospects but are not closing many sales. One manufacturer received an increased number of inquiries.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

The decline in cotton was the climax, or anti-climax, of the drop in commodity prices recorded during the past few months. Within that period most agricultural commodities have sold at what the newspaper writers call "new lows." And the future of all securities that are in the slightest degree speculative has become partially if not wholly dependent upon what the farmer can get for the wheat, corn, cotton, rye and other commodities that he must now dispose of unless he wants to unduly extend the speculation to which he committed himself when he planted the crop. Of course, the harvest he is now gathering might he carried over for another twelve months, for there is nothing unethical in speculation, and if one is compelled to speculate he might as well be intelligent about it.

But for some mysterious reason the farmer hurts his credit by carrying his production long after it has been harvested and the practice in most agricultural countries is to sell as soon as buyers can be found.

The "editorial farmer" is supposed to have a cure-all for such situations. But none of his surgical instruments seem to work this season, and even his friend, the Department of Agriculture, appears to have directed its enormous influence toward impairing rather than increasing the value of the agricultural staples that are grown in America.

In the book of Genesis, Chapter 41 we read: "This is the thing which I have spoken unto Pharaoh: What God is about to do he sheweth unto Pharaoh. Behold there come seven years of great plenty throughout all the land of Egypt. And there shall arise after them seven years of famine; and all the plenty shall be forgotten in the land of Egypt; and the famine shall consume the land. * * * And in the seven plenteous years the earth brought forth by handfuls. And he (Joseph) gathered up all the food of the seven years, which were in the land of Egypt, and laid up the food in the cities; the food of the field, which was round about every city, laid he up in the same. And Joseph gathered corn as the sand of the sea, very much, until he left numbering, for it was without number. * * * And the seven years of plenteousness, that was in the land of Egypt, were ended. And the seven years of dearth began to come, according as Joseph had said; and the dearth was in all lands; but in all the land of Egypt there was bread."

It would be hard to find a more graphic and commonsense account of a national experience that might have destroyed the people of Egypt unless there had been a Joseph to protect them by his leadership. Therefore, we feel warranted in drawing attention to a story which freshly emphasizes the wisdom of buying essential commodities at or under the cost of production.

Indecision, Not Ignorance

Amplification of this statement and our reasons for it are not necessary. The facts are known to most men and their trouble is indecision rather than ignorance.

Of course all forms of American business are directly dependent upon agriculture, and it is gratifying to infer that the improvement in the outlook has justified the Department of Agriculture in raising many of its crop estimates. It is to be hoped that the improvement can be maintained and that the farmers can speedily adjust themselves to the new régime which we appear to be entering. It is gratifying to be able to report some improvement in the oil business, as well as a distinct revival in the demand for anthracite coal.

Shoe Production Up 17 Per Cent

One of the most encouraging items in the week's news is the increase of over 17 per cent from last year in shoe production for the month of June. Two or three years ago we were explaining the decrease in shoe sales by referring to the increased use of automobiles. It was said that everybody was riding and that shoes wore longer than usual. Perhaps our American population may have recently decided to walk a little more. The decrease in the number of passengers hauled by the New York subways suggests this possibility. At all events business men are more cheerful and a slight improvement in the tone and volume of business is almost universally reported.

In Cuba the revolt against the Machado government has assumed serious proportions. As this is written Congress has suspended, and President Machado has gone to the front. The exact object of his going has not been announced, but is surmised to be conciliation and peace if possible, or war to a finish if necessary.

Europe seems to have about made up her mind that she will not be able to borrow much more from the United States for the present. Therefore, she is becoming content with what she has already succeeded in obtaining. The "widow's cruse" was once described by a sailor as a voyage upon which she "cruised" without getting any fresh food. So it has been with Germany, and it will be hard to convince the rest of Europe that her position is as precarious as some insist.

Copyrighted
Theodore H. Price Publishing Corporation
95 Broad St., New York

THE BUSINESS WEEK

August 19, 1931

Bounteous harvest, immemorial metaphor of prosperity, spells poverty instead, in this period of economic paradox . . . Government estimates of bumper crops smashed the hopes of farmers for better prices and smashed the Farm Board's stabilization schemes . . . But they raised McNary-Haugenism from a shallow grave; Congress will be put under the Farm Bureau lash again, to pass the equalization fee as it did twice before . . . The farmer must now pray for boll weevil, rust, drought, foreign crop failure, or adopt the Farm Board's sabotage proposal . . . Commodity markets have been converted to the 5 & 10 cent idea, with rubber, cotton, copper, under 10 cents . . . Our index nevertheless rose, slight upward fluctuations in carloadings, steel, bank debits happening to coincide . . . Steel production probably hit bottom in July . . . There are hopes that Autumn may drag industry out of the mire . . . The copper industry faces an extensive shut-down . . . Though production is slow, consumption is slower . . The oil industry is making heroic efforts to keep production above the rising demand of consumers and is succeeding all too well . . . Retail sales of department store and mail order houses show further curtailment which the recently "adjusted" earnings of wage earners and farmers are not apt to strengthen . . . Germany appears the bright spot on the horizon with her financial difficulties alleviated sooner than expected . . . The difficulties of Austria, Hungary and England are less encouraging . . . With extensive investments frozen, the budget unbalanced, trade in serious straits, England has a Herculean task . . . By comparison, conditions in the United States look rosy.

© The Business Week

Material Trends and Prices . . . .

A sufficient amount of buying in structurals, railway steel and pipe is at hand to keep mill operations at 30 to 32 per cent of capacity. This rate, however, reflects no improvement over conditions as they were three weeks ago. Tin prices rose this week, while those of copper (electro) and lead remained firm. Zinc prices have not as yet re-acted to curtailed production. Copper wire and scrap prices are down.

(All prices as of Aug. 14, 1931)

IRON AND STEEL

Pig Iron—	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$12.00	$12.00	$14.00
Buffalo, No. 2, Fdry., per gross ton	17.00	17.00	16.00
Heavy Melting Steel Scrap—Pittsburgh consuming point, No. 1, per gross ton	10.50	9.50	15.25
Furnace Coke—Connellsville, per net ton	2.40	2.75	2.50
Foundry Coke—Connellsville, per net ton	3.25	3.50	3.50
Steel Shapes—Pittsburgh, base, per 100 lb	1.60	1.65	1.60

•

Iron Machinery Castings—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb:

Chicago....4.62½ Cleveland....4.50 New York....4.75
Cincinnati....4.40 Detroit....4.00

•

Steel Sheets—Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10*	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

* Light plates.

•

Seamless Steel Tubing—Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

—Thickness— of Wall		Outside Dia. in Inches						
		¼	⅜	½	¾	1	1⅛	1¼
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

•

Shapes, Plates, Bars, Etc.—Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

•

Stainless Steel—Hot-rolled bars, base, Pittsburgh, 0.12 per cent carbon, cents per lb:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts—Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots 73–10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:

Aluminum ingots, 99%, N. Y.	23.30
Copper, electrolytic, Conn	7.50
Copper wire, base, Chicago and Cleveland	9.87½
Copper wire, base, N. Y.	9.75
Lead, pigs, E. St. Louis	4.22½
Tin, Straits, pigs, spot, N. Y.	25.00
Zinc, slabs, E. St. Louis	3.82½

Prices following are in cents per lb., base, N. Y., Chi. and Cleve:

Brass rods, high	13.62½
Brass sheets, high	15.37½
Brass tubing, high	20.25
Copper, drawn round	16.12½
Copper sheets	17.62½
Copper tubing	20.12½

Prices following are in cents per lb., del. from N. Y. warehouse:

Babbitt, anti-friction, general service	28.75
Babbitt, com'l, intermediate grade	34.50
Babbitt, genuine, highest grade	44.25
Solder, bar	19.12½

Prices following are in cents per lb., base, Huntington, W. Va:

Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

•

Scrap Non-Ferrous Metals—Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	3.00	4.25	4.00@4.25
Light brass	2.50	3.25	3.25@3.75
No. 1 rod-brass turnings	3.50	4.50	4.00@4.50
Heavy copper	5.50	5.75	6.25@6.75
Light copper	4.50	5.00	5.50@6.00

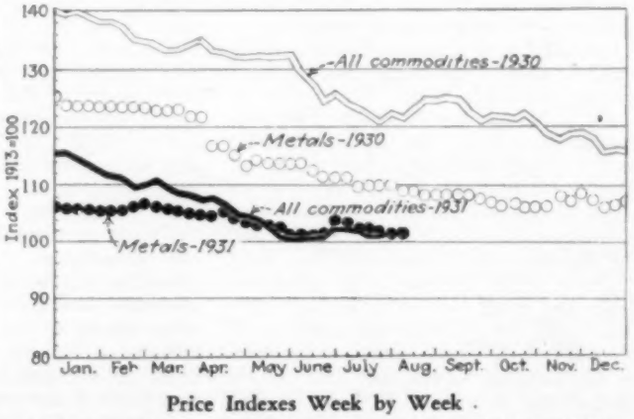
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide mineral, cloth, 6-in. dia., No. 1, less than 200, per 100	$4.36	$4.59	$4.59
Belting, leather, heavy, discount	30–10%	40%	40%
Belting, rubber, trans., 1st grade, discount	60–10–10%	60–10%	60%

Lumber—Per M ft., b.m., 16 ft. lengths, del., N. Y:

Crating—Southern pine:
1x4-in. ..... $27.00 1x6-in. $26.00

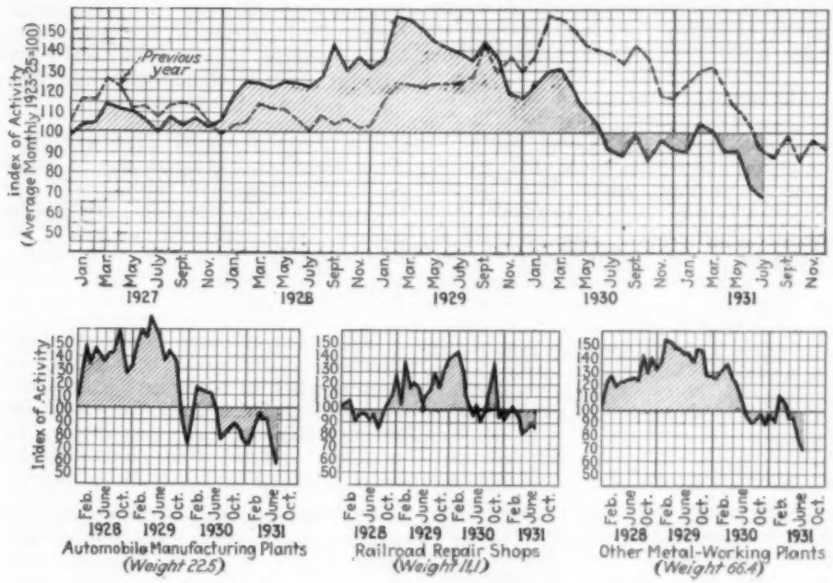
Skids—Spruce:
2x4-in. .$37.00 3x3-in. .$46.00 4x6-in. .$48.00 6x6-in. .$52.50



Price Indexes Week by Week

(6 Metals and 74 Commodities—Figures from The Annalist.)

NEWS



July Metal-Working Operations Show Further Decline

Further declines in all industrial activities were indicated in July by reports on the consumption of electrical energy for power purposes. The final figure of 100.3 in March, 92.4 in April, 92.6 in May and 78.2 in June declined to 68.0 in July. These figures are all adjusted for 26 working days, as are subsequent ones.

The automobile shop index is given as 94.1 for March, 90.8 for April, 91.5 for May, 71.3 for June and 55.9 for July. The railroad repair shop index is given as 94.3 for March, 82.8 for April, 84.7 for May, 89.2 for June and 84.3 for July, only a slight decline after an unexplained rise for the preceding month. Ferrous and non-ferrous metal-working plants outside these two groups have a July index of 69.3 as compared with a June figure of 78.6, a May index of 94.1, April index of 94.6 and March index of 103.5.

When the figures are adjusted seasonally, several-point revisions occur. The railroad repair shop index rises to 92 from 84.3, the metal-working index rises to 73.5 from 69.3 and the automobile index to 56.3 from 55.9. These figures compare with railroad repair shop seasonally adjusted indexes of 96 in June, 82.5 in May, 80.1 in April and 90.3 in March; automobile figures of 69.8 in June, 78 in May, 76 in April and 88.2 in March. The "other metal-working" figure compares with 82.8 in June, 91.7 in May, 92.4 in April and 95.3 in March. These give a seasonally adjusted figure for the entire group of 71.7, as compared with 81.4 in June, 87.3 in May, 87.9 in April and 92.9 in March.

Peru Decreases Duty On Machine Replacements

In order to foster domestic industrial developments, a Peruvian decree, dated July 21, and published and effective Aug. 11, 1931, reduces substantially the rates of import duty on certain machinery replacement parts, classifying all the items affected under item 1581 of the Peruvian tariff, dutiable at the rate of 0.02 sol per gross kilo, according to a cable to the Department of Commerce from Acting Commercial Attaché JULIAN D. SMITH, Lima. The previous rates of import duty on these various items were as follows, in soles per gross kilo:

Item 1581, spare parts for pulleys, shafts and couplings for same, supports, bearings, and integral parts of transmission systems in general, 0.20; item 1581-a, spare parts for flat-iron chimneys, for cast-iron boilers and grates for boilers and ovens, in general, 0.15; item 1581-b, spare parts for unfinished toothed gearings, of cast or forged iron or steel, 0.20; item 1581-c, spare parts for electrical derivation boxes or for meters, of cast or forged iron or steel, weighing less than 50 kilos, 0.50; item 1581-d, spare parts for other machinery, in general, 0.05.

Federal Specifications

A proposed revision Federal Specification No. 140, QQ-I-656 on high-test semi-steel gray iron castings has been issued by the Federal Specifications Board to supersede USGMS 140, dated Aug. 1, 1924. Federal Specification No. 451 on hand tinners' shears is also suggested to supersede USGMS 451.

S.I.E. Convention Scheduled for Pittsburgh

The eighteenth national convention of the Society of Industrial Engineers will be held Oct. 14-16 at Fort Pitt Hotel, Pittsburgh. An address of special interest will be "What Can We Learn from Russia," by JOHN M. CARMODY, editor of *Factory and Industrial Management*, and national president of the Society of Industrial Engineers, who recently spent three months in Russia, inspecting manufacturing plants, steel mills and power plants. LEWIS J. BROWN, president of the Kellogg Co., Battle Creek, Mich., in an address entitled "What Has Happened"? will furnish some interesting data on their experiment of operating on four 6-hour shifts.

The second day of the convention will be known as Gilbreth Day, the program being arranged to commemorate the pioneer work of the late FRANK B. GILBRETH, and its development by DR. LILLIAN M. GILBRETH. In the evening the annual banquet will be held, the principal speaker being JOSEPH W. ROE of New York University, with L. W. WALLACE, executive secretary of the American Engineering Council, as toastmaster.

Second Grace Liner Started at Kearney

GOV. MORGAN F. LARSON, of New Jersey formally launched the Grace Line's $17,000,000 shipbuilding program at noon Aug. 12 when he drove the first rivet in the second keel of the four-vessel program in the yards of the Federal Shipbuilding Co., Kearney, N. J. Between 2,000 and 3,000 workmen will get steady employment for

two years in building the new vessels, ordered under the terms of the Jones-White act of 1928. The new Grace liners are designed for the Panama Mail Service between New York, Central America, Los Angeles and San Francisco. Each will boast of a displacement of 16,000 tons, a length of 508 ft., and will maintain an average speed of nineteen knots. Accommodations will be provided for 300.

Carpenter Discusses English Situation

MAJ. AARON E. CARPENTER, first vice-president of E. F. Houghton & Co., Philadelphia, recounts several interesting facts which he learned during his recent two-month stay in Europe. In talks with English bankers and indus-

trial leaders, Major Carpenter was surprised to find a great change of opinion regarding the so-called dole. He says: "For one thing, the dole eliminates bread lines; and, since it is largely paid by the manufacturer and the State, it is equally distributed and is enough to provide for actual necessities. England is apparently overpopulated, and the dole relieves many of the grave economic problems which today are so prevalent in this country. As a result, the burden is not shouldered by private charities, which, generally speaking, would be inadequate to meet the demands."

In England, the ranks of the idle have been thinned by 250,000 since Jan. 1. While business is by no means thriving, the general outlook is increasingly optimistic.

Erratum

In the July 30 number of *American Machinist*, on page 2241, a photograph of classes at the University of Minnesota was shown, including the statement that daily production was 100 rowboat motors. While the shop is tooled up on a scale that would give a commercial production of about 100 rowboat motors per day, 85 motors per quarter were built by students during the past year.

BUSINESS ITEMS

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., has received new orders totaling $1,006,000 as a result of the recent acquisition of the American Brown Boveri Co., Inc., and the Condit Electrical Mfg. Corp. The orders include contracts for $350,000 with the Long Island Railroad, $460,000 with the Commonwealth Edison Co., Chicago, and $110,000 with the New York Edison Co., for a Yonkers substation. Also, the Condit Electrical Co. has received an order of $86,000 for Hyde Park, Boston.

Aluminum Industries, Inc., Cincinnati, reports capacity operations in the subsidiary plant at St. Cloud, Minn., in the valve division, while the parent plant is working night shifts in the foundry division to meet demands from the new car field. The increase in operations in the valve division at St. Cloud is due to a substantial increase in equipment orders from a car manufacturer who is now on a 1,200-car-a-day basis and the general increase in replacement business. The valve division at St. Cloud has been on a 24-hours schedule for the last four weeks.

The Durabilt Steel Locker Co., Aurora, Ill., has elected the following new officers: E. D. KASER, president and general manager; V. C. KASER, vice-president; H. S. HATCH, treasurer and manager of sales and W. H. GRAHAM, secretary. E. D. KASER was formerly secretary-treasurer and was elected to the presidency following the resignation of C. W. KILLIAN on account of ill health. D. V. TRAPP has been appoined purchasing agent to succeed E. V. PAULY, resigned.

The Toronto (Ont.) Industrial Commission announces the formation of a new Canadian company, Silver-Marshall of Canada, Ltd., which will manufacture Silver-Marshall radios in Toronto for Canadian and export markets. The company has leased approximately 12,000 sq.ft. of manufacturing floor space at 75 Sherbourne St., and operations will commence as soon as the necessary machinery has been installed.

The Diamond Iron Works of Canada, Ltd., a subsidiary of the Diamond Iron Works, Minneapolis, Minn., has been incorporated. It is not the company's intention to build a factory in Canada, but it is making arrangements to have certain of its rock-crushing, conveying, saw-mill and transmission machinery built there.

Negotiations are now going on between the American Manganese Steel Co., Chicago, Ill., and the Montreal Industrial Commission regarding plans of that company to erect a foundry in Montreal. Unofficially it is stated that the company proposes a $2,000,000 plant in the eastern part of the city on the St. Lawrence River.

The Humphrey Co., Bensenville, Ill., manufacturer of oil burners and oil heaters, has taken lease on first floor and part of the second floor of the Lithotype Bldg., 370 No. Brook St., Elgin, Ill., and is moving its equipment to Elgin. H. W. HUMPHREY is president and R. S. ASHBY secretary-treasurer.

The Norma-Hoffman Bearings Corp., Stamford, Conn., has opened a sales office at 1014 American Bank Bldg., Parkway & Walnut St., Cincinnati, Ohio. O. D. KILHAM, for many years sales engineer at the home office and later at the Cleveland office, has been made manager in charge.

The Segal Lock & Hardware Co., Norwalk, Conn., is operating 24 hours' daily producing razor blades and a new one-piece razor taking double-edge blades. New automatic machinery has been ordered with a view to producing about 700,000 blades a year. LOUIS SEGAL is president.

The entire force of the G. M. Diehl Machine plant at Wabash, Ind., has been recalled to replenish factory stock and to fill a large order for a new factory at Bassett, Va. The factory has not been entirely shut down, but has been operating with a curtailed force.

The Maytag Co., washing machine manufacturer, has established a Canadian branch plant in Toronto. The Canadian subsidiary, the Maytag Co. Ltd., will operate the Toronto plant, where at the outset only assembling will be carried on.

Four divisions of the Westinghouse Lamp Co. in Bloomfield and Belleville, N. J., recently received awards of the Newark (N.J.) Safety Council for operating more than a year without a lost-time accident and with a minimum of 120,000 man hours worked.

E. A. Kaestner Co., 516 N. Calvert St., Baltimore, Md., sheet metal and dairy equipment producer, is installing additional equipment, including welding apparatus.

The Udylite Process Co., 3220 Bellevue Ave., Detroit, Mich., has opened an office at 205 Wacker Drive, Chicago. L. A. DAVIES is in charge of sales and R. F. MCGUIRE of service.

PERSONALS

MARTIN B. ARMSTRONG, president of the Thomas & Armstrong Mfg. Co., London, Ohio, has resigned, and been succeeded by R. W. BOYD, president of the London Exchange bank and treasurer of the company, which manufactures sheet metal farm equipment.

E. M. ANDERSON has been appointed purchasing agent of the Massey-Harris Co. division at Racine, Wis., manufacturing tractors and tractor implements. He was formerly connected with the Massey-Harris plant at Batavia, N. Y.

ALFRED LEROY ATHERTON will head a new metal tank mercury arc rectifier division within the circuit breaker engineering department of Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., according to an announcement by R. S. FEICHT, director of engineering. Atherton has been identified with the miscellaneous engineering department and has been engineer in charge of the rectifier development at Westinghouse.

C. A. BANGERT, shop superintendent of the Thomas & Armstrong Mfg. Co., London, Ohio, has resigned to join the W. E. Lamneck Co., Columbus, Ohio.

J. B. COLLUM, director of the Harbison-Walker Refractories Co., Pittsburgh, has resigned and has been succeeded by W. FORMAN BICKEL, treasurer.

H. H. MORGAN, formerly assistant chief engineer in charge of the drafting room of the Palmer-Bee Co., Detroit, and prior to that time on the engineering staff of the Webster Mfg. Co., Chicago, now affiliated with the Weller Mfg. Co., has been made special engineering representative for the Weller Co. in Detroit. He has offices at 10228 Woodward Ave.

F. B. RENTSCHLER, president of the United Aircraft & Transport Corp., New York, has been elected chairman of the board of directors of the newly incorporated United Air Lines, Inc. Subsidiaries of the new company are Boeing Air Transport, National Air Transport, Pacific Air Transport and Varney Air Lines. Other officers are: Vice-presidents, LESTER D. SEYMOUR and PAUL HENDERSON; treasurer, C. F. BRINK; secretary, F. G. MCCARTHY.

R. E. WALKER, formerly in the Kansas City, Mo., office of the American Rolling Mill Co., Middleton, Ohio, has been placed in charge of the company's office at 738 Mayo Bldg., Tulsa, Okla.

ROY J. WENSLEY, creator of the televox, first of the mechanical robots, has been transferred from the East Pittsburgh engineering department, Westinghouse Electric & Mfg. Co., to the meter department of the Newark works, according to announcement of R. S. FEICHT, director of engineering. Mr. Wensley has been with Westinghouse since 1916.

RONALD WILSON, formerly of the engineering staff of Brown & Sharpe Mfg. Co., Providence, R. I., has joined the engineering staff of the Superior Machine Tool Co., Kokomo, Ind., on designs of special machines.

OBITUARIES

ALVAC CLYMER DINKEY, 65, president of the Midvale Co., Nicetown, Philadlephia, Pa., and a leader in the steel industry, died of heart disease Aug. 11 after a three months' illness. Mr. Dinkey, who was a brother-in-law of CHARLES M. SCHWAB, chairman of the board of the Bethlehem Steel Corp., had been associated with the steel business most of his life. He obtained a job as water boy at one of the Carnegie plants at the age of 13 and 24 years later was president of the Carnegie Steel Co.

HARRY R. ARMSTRONG, 72, president of the National Iron Works, Duluth, Minn., was drowned at Laguna Beach, Calif., July 31.

EUGENE J. ESLEIN, 44, one of the founders and former vice-president of the Esline Co., Oconomowoc, Wis., died Aug. 5 after a year's illness.

BRUCE FORD, 59, inventor and engineer who for years had been considered a leading authority in the storage battery field, died in Philadelphia, Aug. 10, after a brief illness. He was second vice-president and a director of the Electric Storage Battery Co., of which until recently he had been general manager. He had been connected with the company continuously since 1899.

LIEUT.-COL. WILLIAM MOIR GARTSHORE, 78, president of the McClary Manufacturing Co., died at his London home on July 26. Col. Gartshore began his business career in 1867 in the shops of his father's foundry at Dundas, Ont.

EDWARD W. KERR, 65, for 30 years one of the principal department managers of Pratt & Letchworth Inc., Buffalo, N. Y., who retired two years ago, died Aug. 8 there, following a short illness.

GEORGE C. NEWTON, 36, departmental manager of the Erie Bolt & Nut Co., Erie, Pa., died Aug. 8 there, following a brief illness.

JOHN EDWARD OGDEN, 61, president of the J. Edward Ogden Co., J. Edward Ogden Ltd., and the Star Expansion Bolt Co., New York City, died Aug. 11 after an illness of several months. He founded the companies between 1903 and 1909.

SAMUEL T. WAGNER, 70, consulting engineer of the Reading railroad, and

vice-president of the American Society for Testing Materials, died at his home in Philadelphia on Aug. 7.

FRANK ROCKWELL, 62, owner of the Grand Rapids (Mich.) Ornamental Iron & Wire Works, died July 29.

MEETINGS

SOCIETY OF AUTOMOTIVE ENGINEERS
National aeronautic meeting, Sept. 1-3, Hotel Statler, Cleveland. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

INTERNATIONAL ASSOCIATION FOR THE TESTING OF MATERIALS
First Congress, Sept. 6-12, Buildings of the Swiss Federal Polytechnicum, Zurich, Switzerland. C. L. Warwick, secretary-treasurer, A.S.T.M., 1315 Spruce St., Philadelphia, Pa., or W. H. Fulweiler, A.S.T.M. representative on the Permanent Committee, Chemical Engineer of the United Gas Improvement Co., Philadelphia.

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.
First fall meeting, Chicago, Sept. 17, Granville P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

NATIONAL METAL CONGRESS AND EXPOSITION
Exposition on Commonwealth Pier and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Meetings of American Welding Society and American Society for Steel Treating in connection. Information from W. H. Eisenmann, secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS
National production meeting, Detroit, Mich., Oct. 7-8. John A. C. Warner, secretary, 29 W. 39th St., New York.

SOCIETY OF INDUSTRIAL ENGINEERS
Annual meeting, Pittsburgh, Pa., Oct. 14-16. George C. Dent, secretary, 205 W. Wacker Drive, Chicago, Ill.

NATIONAL SAFETY COUNCIL
Twentieth Annual Safety Congress, Chicago, Ill., Oct. 12-16. W. H. Cameron, secretary, 20 North Wacker Drive, Chicago.

GRAY IRON INSTITUTE
Fourth annual convention, West Baden Springs Hotel, West Baden Springs, Ind., Oct. 15-16. J. Arthur Tuscany, secretary, Terminal Tower Bldg., Cleveland.

AMERICAN MANAGEMENT ASSOCIATION
Industrial marketing conference, Hotel Statler, Cleveland, Ohio, Oct. 21-23. Headquarters, 20 Vesey St., New York, N. Y.

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.
New York meeting, Oct. 22. Granville P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
National transportation meeting, Washington, D. C., Oct. 27-29. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION
Annual convention, New York, N. Y., Nov. 17-19, devoted to the general theme of Coordinated Industrial Planning. Headquarters, 20 Vesey St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Annual meeting, Engineering Societies Bldg., New York, N. Y., Nov. 30-Dec. 5. Calvin W. Rice, secretary, 29 West 39th St., New York, N. Y.

FIRST NATIONAL EXPOSITION OF MECHANICAL HANDLING EQUIPMENT
Grand Central Palace, New York, N. Y., Nov. 30-Dec. 5. Charles F. Roth, secretary, Grand Central Palace, New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Ala., Birmingham—Alabama National Guard, 106th Observation Squadron Air Corps, appropriated $142,000 for the construction of a hangar, repair shop, administration building, etc. at municipal airport.

Ark., Conway—Arkansas State Teachers College, H. L. McAlister, Pres., plans a 2 story vocational building for use at departments of industrial arts and agriculture. Estimated cost $150,000. Wittenborg & Deloney, Home Insurance Bldg., Little Rock, Archts. Project indefinite, depending on sale of bonds.

Calif., Mare Island—Bureau of Yards & Docks, Navy Dept., awarded contract for improvement to bulidings 34, 40, 42 and 48, pipe and copper shop at Navy Yard here. $18,696.

Ga., Brunswick—City Council, plans an election to vote $150,000 bonds for the construction of a municipal airport including hangars, repair shops, etc.

Ill., Chicago—Pressed Steel Car Co., Farmers Bldg., Pittsburgh, Pa., awarded contract for the construction of a 1 story factory here. Estimated cost $60,000.

Ind., Fort Wayne—Zollner Machine Co., awarded contract for a 1 story, 50 x 150 ft. factory on Bueter Road. Estimated cost $45,000.

Ia., Council Bluffs—Illinois Wire & Mfg. Co., J. M. Denning, Pres., Joliet, Ill., manufacturers of snow fence and other products, will soon build a 1 story, 28 x 72 ft. factory on South Ave. here. Estimated cost $25,000.

La., Bossier City—W. P. Lincoln, has work under way on the construction of a 1 story, 110 x 225 ft. factory for the manufacture of steel tanks and other plate products. Estimated cost $30,000.

Md., Baltimore—Baltimore Ship Repair Co., 821-23 Key Highway, plans a 1 story, 30 x 70 ft. addition to shop. Estimated cost $40,000.

Md., Baltimore—Campbell Metal Window Corp., Bush and Hamburg Sts., manufacturers of patent windows, plans two 1 story, 50 x 135 ft. and 50 x 130 ft. buildings for use as steel storage in which will be installed traveling cranes and other steel handling machinery. F. Davis, is vice-president.

Md., Baltimore—Coast Guard Station, Curtis Bay, awarded contract for a 1 story, 62 x 85 ft. building for use as a gas engine shop and boat basin. $10,600.

Md., Baltimore—C. J. Phillips, 1334 Greenmount Ave., plans the construction of a 2 story plant for the manufacture of tools for plumbers, bricklayers, boiler makers, stone cutters, etc. at 645-653 East 25th St.

Mass., Boston—Boston Terminal Co., A. V. Russell, in charge, South Station, plans the reconstruction of 1 story garage, from terminal basement at Atlantic Ave. and Summer St. Estimated cost $40,000. Private plans.

Mass., Boston—Shell Eastern Petroleum Products Co., 141 Milk St., awarded contract for a 1 and 2 story, 85 x 140 ft. garage and service station at Commonwealth Ave. and Cottage Farm Bridge. Estimated cost $50,000.

Mass., Brighton (sta. Boston)—Dept. of Public Buildings, is having plans prepared for a 1 story garage at Police Station, 14 Washington St. Estimated cost $40,000. J. M. Gray, 175 High St., Boston, Archt.

Mass., Charlestown (sta. Boston)—Charlestown Five Cent Bank, 1 Thompson Sq., plans reconstruction of garage, 5 story, 80 x 175 ft. at 81 Wareham St. Estimated cost $40,000. A. Rosenstein, 120 Milk St., Boston, Archt. Work will be done by separate contracts.

Mass., Franklin—R. Vozella, City Mills, is receiving bids for a 1 story, 90 x 100 ft. automobile service station and showroom at 42 East Central St. here. Estimated cost $40,000. Private plans.

Mass., Lowell—Lowell Electric Light Corp., 35 Market St., awarded contract for the construction of a 2 story service building on Perry St. Estimated cost $125,000. Noted March 19.

Mich., Detroit—Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., awarded contract for the construction of a 2 story storage and distribution plant here. Estimated cost $65,000.

Mich., Ishpeming—Sunblad Bros., Cleveland Ave. and Second St., awarded contract for a 1 story, 65 x 100 ft. repair and service garage. Estimated cost $20,000.

Mich., Menominee—J. W. Wells Lumber Co., A. C. Wells, Pres., awarded contract for a 1 story, 100 x 150 ft. warehouse, and dry kilns, also 1 story, 80 x 175 ft. flooring factory.

Minn., Barnum—Kain Auto Co., is having plans prepared for a 1 story, 75 x 75 ft. repair and service garage. Estimated cost $20,000. H. W. Wold, 5701 Grand Ave., Duluth, Minn., Archt.

Minn., Mankato—Holt Motor Co., 1301 Harmon Pl., Minneapolis, awarded contract for a 1 story, 69 x 158 ft. repair and service garage on Second St. here. Estimated cost $30,000.

Minn., Minneapolis—R. H. Fairfield, Wayzata, awarded contract for a 1 story, 60 x 90 ft. repair and service garage at Wayzata, Lake Minnetonka. Estimated cost $15,000.

Minn., Minneapolis — D. Rosenstein, Spring Park, Lake Minnetonka, is having plans prepared for a 1 story repair and service garage at Chicago Ave. and 15th St. Estimated cost $20,000. Liebenberg & Kaplan, 710 McKnight Bldg., Archts.

Minn., Minneapolis—Warren Shade Co., J. K. Heymer, Mgr., 1115 Buchanan St. N. E., manufacturers of venetian and porch shades, awarded contract for a 1 story, 80 x 129 ft. factory at 2901 East Hennepin Ave. Estimated cost including equipment $30,000.

Minn., St. Paul—Brown & Bigelow, C. A. Ward, Gen. Mgr., Quality Park, is having plans prepared for the construction of a 3 story factory for the manufacture of playing cards. Estimated cost $250,000.

Mo., St. Louis—Phillips Petroleum Corp., 6291 Suburban Ave., St. Louis, and Bartlesville, Okla., awarded contract for the construction of fourteen automobile gasoline and oil service stations at various points in St. Louis. Estimated cost $150,000.

Mont., Polson — A. McIntire, awarded contract for the construction of a 1 story, 100 x 100 ft. repair and service garage. Estimated cost $20,000. Clines Motor Co., lessee.

N. J., Bloomfield — General Electric Co., Laurence St., postponed construction of a 1 story addition to factory. Estimated cost $40,000. Private plans. Maturity indefinite. Noted July 23.

N. J., Bordentown—Dept. of Institutions & Agencies, W. J. Ellis, Commissioner, State Office Bldg., Trenton, will soon award contract for two industrial buildings, each 2 story, 35 x 268 and 35 x 185 ft. Estimated cost $150,000. Division of Architecture & Construction, State Office Bldg., Trenton, Archts.

N. Y., Mamaroneck—Chattsworth Furniture & Decorating Co., Larchmont, plans the construction of a service building, workroom, and store on Boston Rd. here. Estimated cost to exceed $40,000. Maturity late Sept.

N. Y., New York—Salvatore Cincelli, 239 Arthur Ave., will receive bids after Aug. 20 for a service garage at Hoffman and 184th Sts. Estimated cost to exceed $40,000. M. W. Del Gaudio, 545 5th Ave., Archt.

N. Y., New York—Five Hundred Forty One West 20th St. Construction Corp., J. S. Kahn, Pres., 285 Madison Ave., plans the construction of a 3 story service garage at 537 West 20th St. Estimated cost $120,000. W. Shary, 22 East 17th St., Archt.

N. Y., New York—Grand Allen Holding Corp., 16 Court St., Brooklyn, awarded contract for the construction of shop, furniture show rooms and storage building at 314 Grand St. here. Estimated cost $50,000.

N. Y., New York—J. F. McGowan Marble Co., 1180 Randall Ave., will soon award contract for the construction of a service garage at Leggett Ave. and Barry St. Estimated cost $40,000. Private plans.

N. Y., New York—Augestina Monteleone, 2952 Park Ave., will build a service garage at 152nd St. and Park Ave. Estimated cost $40,000. M. W. Del Gaudio, 545 5th Ave., Archt. Work will be done by day labor and separate contracts.

N. Y., New York—Pustet & Co., 52 Barclay St., manufacturers of church goods, awarded contract for altering 5 story manufacturing and storage building at 14 Barclay St. Estimated cost $40,000.

O., Cleveland—Board of County Commissioners, Court House, will receive bids in September for a 2 story, 100 x 180 ft. garage, storage and distribution plant. Estimated cost $150,000. P. L. Koklauner, Court House, Archt. Noted June 4.

O., Galion—Gledhill Road Machinery Co., E. C. Gledhill, Pres., will soon award contract for a 1 story, 90 x 200 ft. factory. Estimated cost $50,000. W. H. Hatch, Hippodrome Annex Bldg., Cleveland, Archt.

O., Painesville — Ford Motor Co., 3674 Schaefer Road, Dearborn, Mich., plans the construction of an assembly plant at Grand River Harbor here. Estimated cost $7,000,000. Maturity indefinite.

O., St. Marys—St. Marys Foundry Co., had plans prepared for a 1 story, 40 x 150 and 30 x 120 ft. addition to foundry. Estimated cost $50,000. Austin Co., 16112 Euclid Ave., Cleveland, Archt. and Engr.

Pa., Ambridge—Spang Chalfant & Co., G. Fisher, Pres., Clark Bldg., Pittsburgh, is receiving bids for a 1 story, 125 x 500 ft. experimental electric weld pipe mill here. Private plans. Noted Aug. 6.

Pa., Hershey—Board of Trustees, Hershey Industrial School, plans the construction of several new buildings including an industrial and vocational shop. Estimated cost including equipment $1,000,000.

S. D., Marty—St. Paul's Indian Mission, S. Eisenmann, Supt., has work under way on the construction of a 1 story, 60 x 64 ft. shop. Estimated cost $20,000. G. B. Hilgers, 502 United Bank Bldg., Sioux City, Ia., Archt. Work being done by day labor.

S. D., Yankton—Old Hen Brooder Co., manufacturer of brooders and other metal products, plans the construction of a factory at Sixth Ave. and Burleigh St.

Tex., Beaumont—City will receive bids about Aug. 20 for the construction of a shop building, runways, etc., for municipal airport. Estimated cost $50,000. R. C. Black, City Hall Engr.

Tex., Fort Sam Houston—A. S. Harrison, Constructing Quartermaster, has completed sketches for proposed five year building program to include officers quarters, hospital, quartermaster warehouses, new barracks, shops and sheds, etc. Estimated cost approximately $15,000,000.

Tex., Corpus Christi—Southern Alkali Corp., subsidiary of Pittsburgh Plate Glass Co., Grand Bldg., Pittsburgh, and American Cyanamid Co., 535 5th Ave., New York, plans the construction of a plant for the manufacturing of commercial chemicals here. Estimated cost $10,000,000. Maturity November or later. Noted May 14.

Utah, Ogden — State Building Commission, Capitol Bldg., Salt Lake City, received low bids for remodeling main building at State Industrial School here. Estimated cost $40,000. E. F. Piers, Ogden, Archt. R. K. Brown, c/o State Building Commission, Engr. Noted Apr. 6.

Wis., Madison—U. S. Dept. of Agriculture, Washington, D. C., received lowest bid for the construction of a 6 story, 277 x 469 ft. forest products laboratory, from C. B. Fritz Co., Madison, $727,648. Holabird & Root, 333 North Michigan Ave., Chicago, Ill., Archts. Noted Aug. 13.

Wis., Plymouth—Board of Education, plans a new junior and senior high school to include vocational shops, etc. Estimated cost $250,000. M. Tullgren & Sons Co., 1234 North Prospect Ave., Milwaukee, Archts.

Wyo., Casper—State Highway Department, Capitol Bldg., Cheyenne, had plans prepared for a 1 story, 80 x 100 ft. mechanical and industrial shop here. Estimated cost $35,000. Goodrich & Krusmark, Turner-Cottman Bldg., Cheyenne, Archts.

Ont., Toronto—Board of Education, 155 College St., awarded masonry, carpentry and other contracts for a 3 story addition to Danforth Technical School on Greenwood Ave. Total estimated cost $250,000. C. E. Dyson, 155 College St., Archt.

Equipment Wanted

N. Y., New York—R. W. Rodman, Supt. of Plant Operation of Board of Education, 131 Livingston St., Brooklyn—will receive bids until Aug. 28 for furnishing, moving and installing shop equipment, shop ventilation, etc., in P. S. 74 (Central Building Trades Continuation School) and in James Monroe High School.

Tex., San Marcos—San Marcos Independent School District—manual training equipment for proposed 2 story elementary and high school. Estimated cost $200,000.